the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JULY 4, 1960

How Atlantic operates SLAUGHTER FLOOD

p. 91

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Commercial scouting now covers 15 states ▸ 63

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▲ Loading at the Port of Houston

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▼ Under erection Suntide Refining Company

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OIL AND GAS JOURNAL
Vol. 58, No. 27

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TECHNOLOGY—OPERATION

Refining-Processing

What Refinery Simulation Involves at Phillips 85

By E. W. Mills

The company uses process-flow calculations to simulate total refinery operations. This technique avoids the explanation and examination of complex mathematics before plant personnel can use the simulation. Dynamics of individual unit operations can be expressed accurately and in detail. Optimum techniques and linear programs can be included as a part of the over-all program whenever desirable.

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Are depreciation allowances inadequate?

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Quiz on fluid flow. This follows a 10-part series on this subject.

Paint Gives Warning of Dangerous Hot Spots 118

By W. F. Connors

Early warning of trouble is provided at Humble's Baytown refinery by silicone-based temperature-indicating paints—paints that change color when the surface gets too hot. They are used on catalytic crackers, reformer reactors, pressure vessels, flue-gas collectors, and heat exchangers.

Drilling-Production

Stuffing-Box Lubricator Cuts Cost of Operation of Mud System 89

By Ed McGhee

The automatic lubrication thus provided lengthens the life of both pump rods and rod packing. More than 20 lubricators have already been installed on rig pumps and some have operated trouble-free for 3 years.

How Atlantic Operates the Slaughter Flood 91

By Roger E. Sessions

The world's most closely watched injection project is using LPG, then gas, then water to gain greater oil recovery. The process, still in the experimental stage, is far from the goal of complete recovery, but with sound engineering and careful planning it can result in the production of large quantities of "unrecoverable" oil.

Reservoir Engineering—24 106

By E. T. Guerrero and F. M. Stewart

How to analyze capillary-pressure data.

What to Do When Well Kicks While Making a Trip 110

By T. B. O'Brien and W. C. Goins, Jr.

Part 3 of three parts. Only swabbing or failure to fill the hole can cause the kick. Therefore the factors which lead to swabbing should be determined and watched closely. A well should always be filled when drilling with fluid any time pipe is pulled from the hole.

Oil-Well Pumping—4 120

By Joseph Zaba

How force application can be made efficient.

Pipelining

Avoiding Shorts with Test Leads 126

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Many erroneous conclusions can be drawn if shorts are allowed to occur.

How to Purge a Gas Pipeline 128

By Clinton McClure

Here is a rundown on the several methods now in use.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
July 4, 1960

Crude surplus in the Mid-Continent should be eased some by these moves:

Louisiana set its July-August allowable at the same level as the two previous months. New production will raise the average slightly to 961,738 bbl. daily.

The state's new curb on multiple completions is still in effect. There's been a lot of talk about it, but no companies have pushed for a revocation. The commission will review the order at a public hearing August 10-11 (p. 73).*

Lowest legal production schedule in Kansas has been set again for July. The same level was produced in June. This month daily production will be about 293,000 bbl.

Oklahoma's lowest allowable in 6 years—that's this month's schedule in the Sooner State. The Corporation Commission whacked the allowable 20,000 bbl. below the June rate of 507,000 bbl. per day.

Refiners have their seasons mixed.

They had winter runs for the last two full weeks of June. The increase in the 2-week period ended June 24 totaled 395,000 bbl. daily. The big jump brought industry runs to 8,231,000 bbl. daily, the highest since the week of January 15.

January-size runs in June can't be justified on a basis of need for products. Total demand for petroleum in the week ended June 24 was about 1,700,000 bbl. daily less than it was in the January week with comparable runs.

This demand difference shows up in a big way in product stock changes. Four major product stocks increased 4,000,000 bbl. for the week ended June 24.

▼ ▼ ▼

Natural-gas producers are captive sellers.
That's the effect of U. S. Supreme Court decision in two

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

parallel cases. In a 5-4 decision the court held that once a gas producer starts selling gas to an interstate pipeline company, he's hooked—he must keep selling permanently. The dissenters said the majority had "strained the provisions" of the natural gas act. (p. 57).

Petrochemical industry in North America expands at fast clip. Latest study by The Journal shows 122 new projects under way or planned—about twice as many as were reported last year at this time in the U. S. and Canada. Of the total, 106 are in the U. S. The projects represent an investment of more than $530 million.

▼ ▼ ▼

A boom in Canadian exploration is expected.

Crews will be Arctic island-hopping soon to make detailed evaluations of acreage won in the latest Canadian offering. Exploration permits covering 44,000,000 acres in the islands and offshore areas have been granted.

The most territory—4,450,000 acres in the Arctic—went to Cree Oil of Canada (1958). Dominion Explorers picked up more than 4,000,000 acres.

An early starter is Mobil Oil of Canada which has begun a marine seismic program near Sable Island.

Southeastern Louisiana rank-wildcat gets pay.

A wildcat in Tangipahoa Parish, one of the state's "Florida parishes," has found oil in the Lower Tuscaloosa. The well flowed at the rate of 27 bbl. per hour while testing through 12/64-in. choke (p. 60).

This strike will quicken interest in the row of barren parishes just south of Mississippi. Drilling has been picking up here (p. 149).

New coal research program gets congressional approval.

The Senate has joined the House in voting for a bill to establish a director of coal research in the Department of Interior who will push a program of short-range research. The aim of the $2-million-a-year project: Help coal now by improving mining, preparation and uses of coal.

A long-range research effort is already being conducted by the Bureau of Mines.

It's official—there are no plans to cut crude import quotas this year.

That's the word from Interior Secretary Fred Seaton. It seems to kill hopes of producer groups who have been pushing for reductions as a way to improve domestic operations.

However, the secretary is still open to suggestions to improve the control program (p. 69).

First report on Atlantic's triple-slug flood:

Expected recovery of 62% of the oil in Slaughter field seems assured.

The desired operating pressure has been achieved, but only after injecting nearly 3 million barrels more than originally planned.

The company first injected LPG, then gas, and finally water in the West Texas field (p. 91).

Reasons for decline in freshman engineering enrollment in the United States:

...Increased interest by top students in other fields of science, especially "space-age" subjects.

...Distaste for rigors and demands of engineering study.

...Decline in applications from students who really had no aptitude or real interest in engineering.

These were revealed by special survey of Engineering Manpower Commission of Engineers Joint Council. Advice from many college deans: The profession needs to establish more effective means of communicating to young people the facts about engineering, its importance, and its rewards.

▼ ▼ ▼

The board of Venezuela's new national oil company is expected to include these familiar faces:

Dr. Juan Pablo Perez Alfonzo, the country's minister of Mines and Hydrocarbons; Dr. Edgar Pardo Stolk, manager of the government's petrochemical institute; and the managers of the four oil ministry divisions, Dr. Luis Jacobo Cordero, Dr. Luis Plaz Bruzual, Dr. Abel Monsalve, and Dr. Domingo Noriega Salazar.

First nuclear powered tanker to be built by Danish firm.

Danatom plans a 790-ft. tanker with a capacity of close to 450,000 bbl. It is scheduled for the Persian Gulf-U.K. run. It will use the heavy water reactor that propels the Soviet icebreaker and will power the U. S. merchant ship Savannah.

Full potential of electronic computing to help run the oil business has hardly been scratched.

Experts say one barrier is fast, long-distance data transmission. Another is bigger and faster hardware.

When these are cleared, it will be possible to keep tab on a company's crude, product, and cash flows at any point. A fantastic job today—perhaps commonplace tomorrow.

Market Memo

July 4, 1960

By the time refiners quit cussin' other refiners, runs go up again.

Crude runs, like money, are a positive force in the industry. Money love and high runs are the roots of today's evils.

Runs to stills should be like molasses—thin in summer and thick in winter, if supply is to match demand. But if stocks are two thick and runs too thick, then profits are thin.

Gulf Coast middle distillates and Bunker C, both with thin inventories, have increased posted prices. Gasoline, with thick stocks, is laboring for higher posted prices. Higher spot prices must be asked by Gulf Coast refiners if better posted prices are to be obtained.

Gulf Coast prices are firmer. No. 2 fuel and gas oils advanced in posted prices one-eighth cent per gallon and Bunker C rose 10 cents to a new price of $2.20 in the last fortnight.

No. 2 is firm at eight and one-eighth cents and Bunker C is very firm at $2.20 posted price, with lof-sulfur No. 6 tight at $2.45 per barrel.

Gulf Coast gasoline needs demand. It is available at a quarter to three-eighths cent off posted prices, dependent on octane, with 92 RON posted at ten and three-quarters cents.

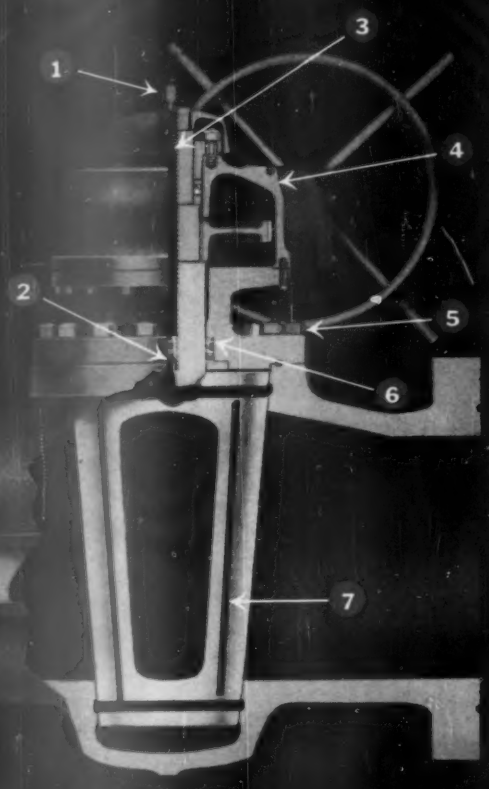
July's 8-day Texas allowable has firmed both Texas and Louisiana Gulf Coast crude oils.

Mid-Mississippi River prices on gasoline, as well as burning oils, are holding firm. Gasoline ranges from Gulf Coast low at Arkansas City to one-half cent over Gulf Coast low at West Memphis. Offerings are closely held. Several refiners report sold-up positions well into July on gasoline and are reluctant to push No. 2 sales because of unattractive prices.

Chicago posted prices on gasoline are very firm with 91 RON at 12 cents. Fourth of July demand may have given the needed shot in the arm for higher gasoline prices. No. 2 in Chicago, posted at eight and one-half cents, is ready for an advance, since this product has increased in price one-quarter cent in Group 3 and one-eighth on the Gulf Coast during the past two weeks.

Group 3 northern shipment gasoline is steady at posted lows of eleven and one-half cents for 91 RON. The eight-cent posting for No. 2, while better than it has been, is still too low to be attractive to those refiners who have storage to hold it.

7 characteristics that make WALWORTH a better Lubricated Plug Valve



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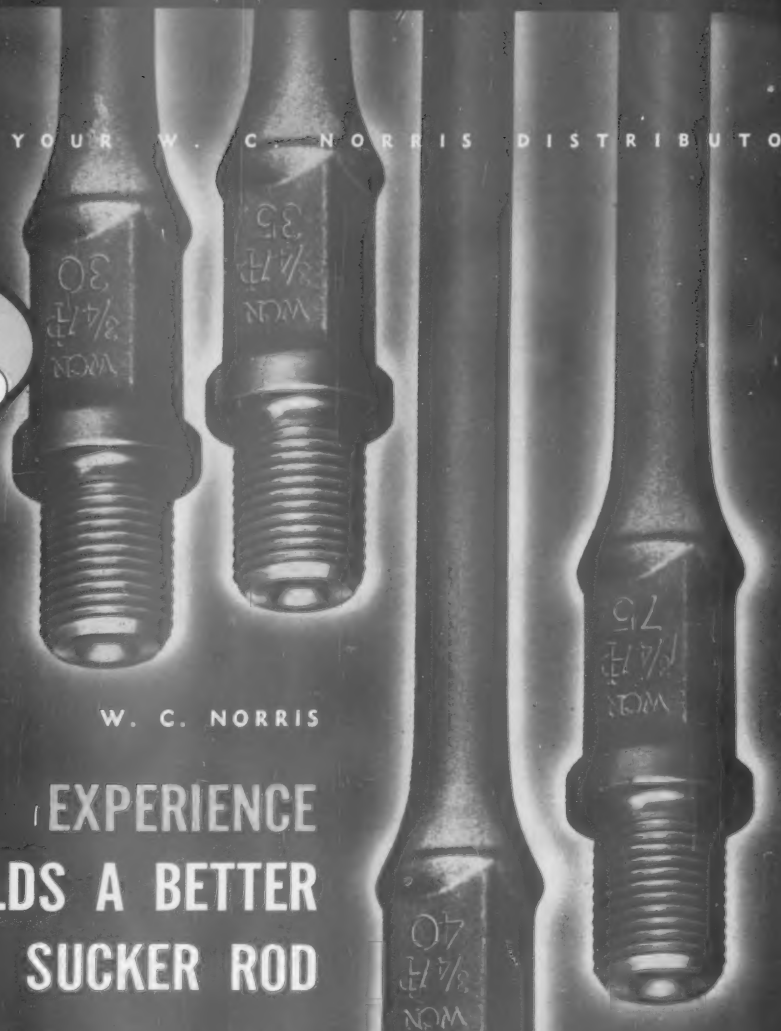

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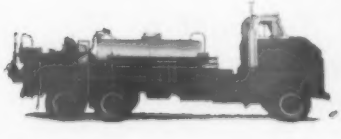

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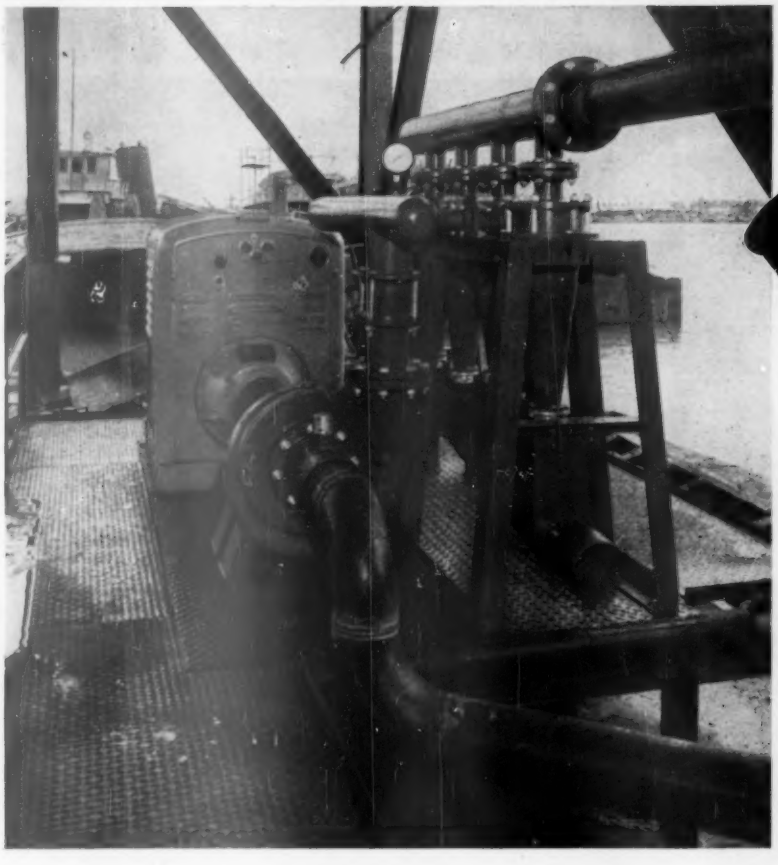

DEMCO Desanders made by Drilling Equipment Manufacturing Company, Oklahoma City, are equipped with Hycar liners molded by Wyatt Industries, Inc., Houston. One unit will treat 150 to 250 gallons of drilling mud per minute—units can be mounted in banks, as shown here, for additional capacity. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

Desanders demonstrate how Hycar withstands extreme abrasion in oil service

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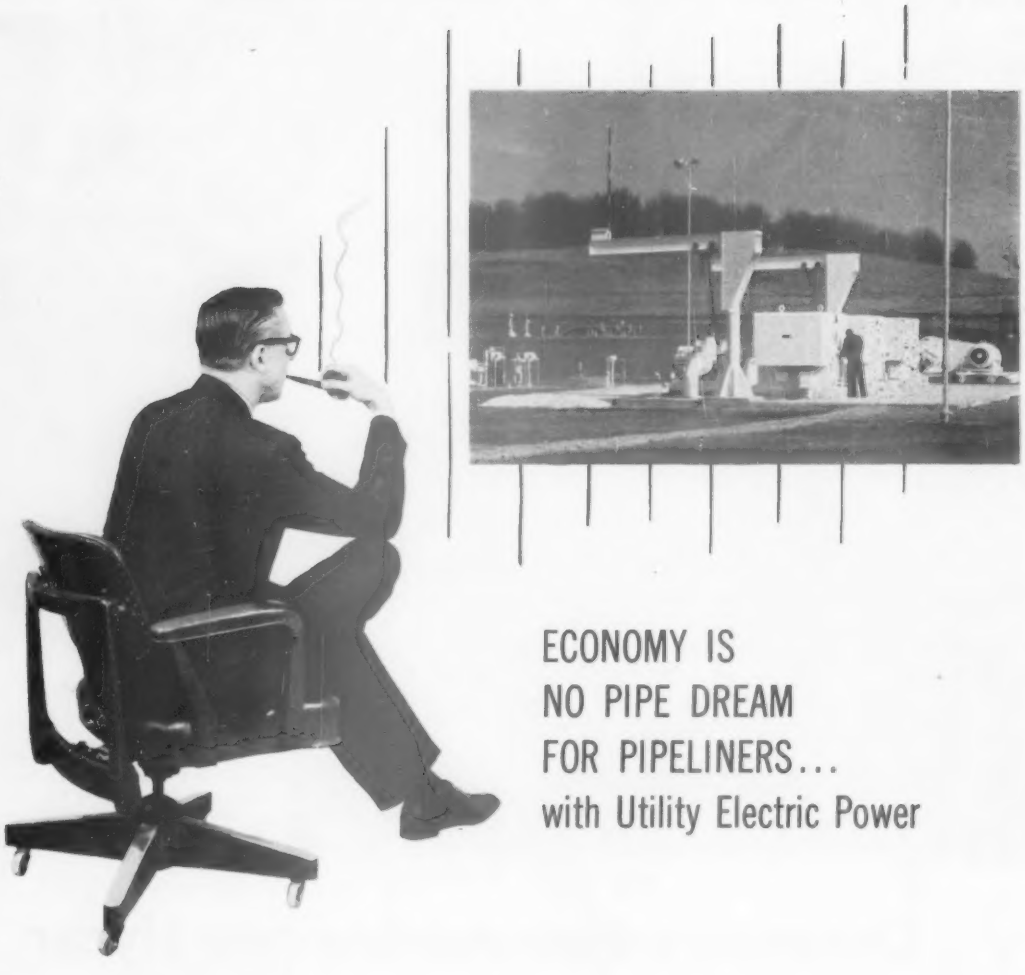
Memo to Management:



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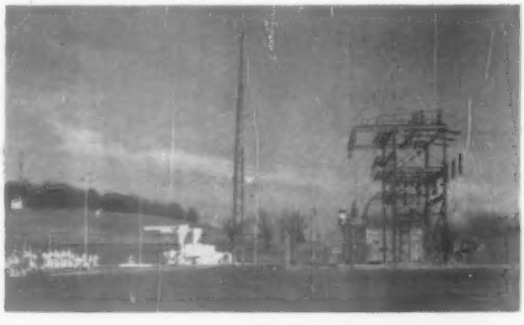
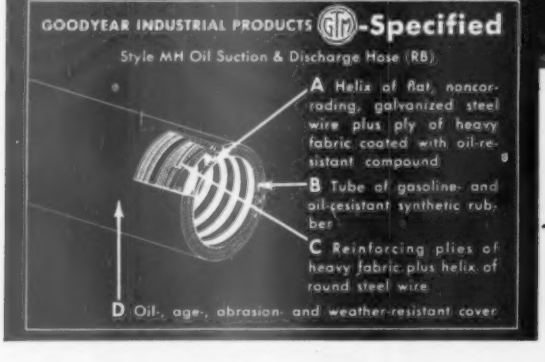


Here's hose designed for the toughest oil-handling jobs at docks and refineries. It's MH Oil Suction and Discharge Hose developed by the G.T.M. – Goodyear Technical Man – and his colleagues. And it's built with a tube of oil-resisting synthetic rubber to carry millions of gallons of oil, gasoline, solvents–even butane. The tough, abrasion-resistant cover can withstand constant dragging back and forth over rough piers and sharp ships' plates. Multiple helices of heavy steel wire guard it against kinking or crushing–multiple plies of heavy fabric armor it against abuse. Here, then, you have an oil-handling hose that will not only serve you longer–but do it at the lowest over-all cost.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OTIS PRODUCTION NEWS

Volume I, Number 2 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

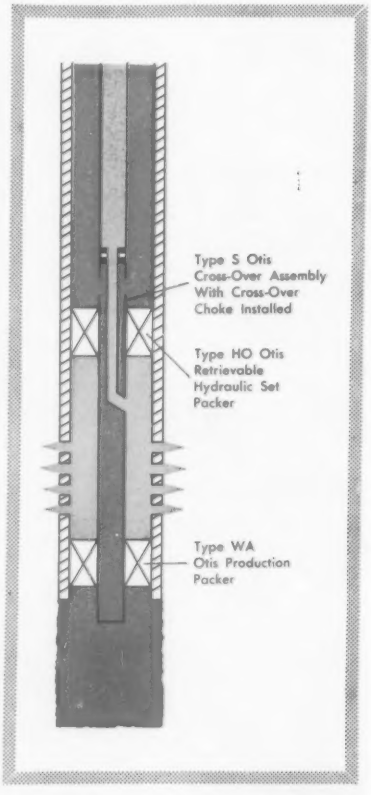
Otis 'Packaged' Well Completion Service Proves Solution To $80,000 Problem For Aggressive Oklahoma Operator

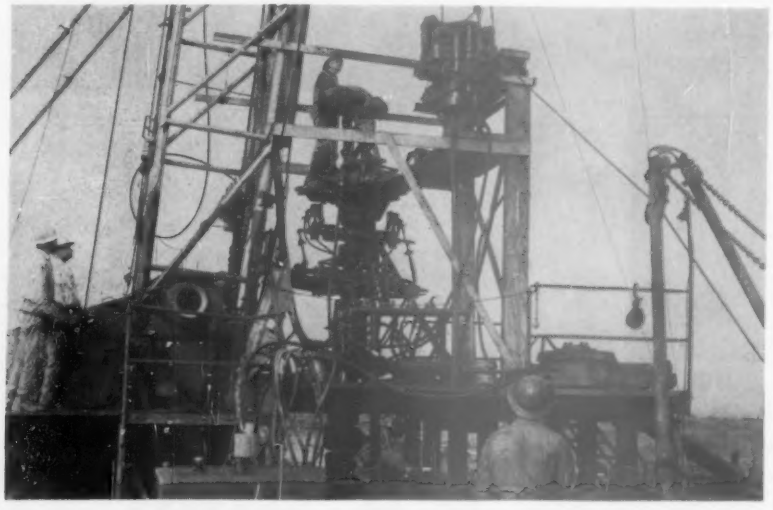
OKLAHOMA CITY — Otis well completion specialists from the Lindsay division have performed a slightly different, but basically sound, technique of completing a number of single string. dual producers for one of Oklahoma's most progressive independent operators. The wells are located in a new field being developed by this producer.The technique is that of snubbing all downhole production equipment into each well under pressure instead of killing the well. This technique has solved a problem which cost this operator some $80,000 on one well he drilled and completed in this field by another method.

The costly problem well potentialed 400 B.O.P.D. when originally swabbed in following a down-casing well stimulation treatment. Faced with not having production equipment in the well for either zone, and a 600 P.S.I. shut-in pressure, the operator decided to kill the well with a heavy lease oil before running packers and tubing. After necessary production equipment had been installed all attempts to swab the well in again failed, as did numerous special zone-stimulation fluids and treatments during the following 2½ months. When the well was finally brought in for the second time, its daily potential was considerably less than the initial 400 B.O.P.D. All told, the well owners counted a staggering $80,000 spent to get production back. Since that time Otis has been engineering the completions for this operator and snubbing all equipment into the hole under pressure. The cost of Otis' Snubbing Service has averaged less than $2,000 per well.

The completion equipment consists of a Type WA Otis Production Packer, a Type HO Otis Hydraulic-Set Packer, and a Type S Otis Cross-Over Assembly. The WA packer is a permanent-type, wire line set production packer which is used to isolate the two producing zones. The top packer is the Type HO Otis Hydraulic-Set Tubing Retrievable Packer, which is set by pressuring up on the tubing after first landing a special setting tool in the cross-over assembly made up in the packer.

In this type of installation the top packer is tested by bleeding off pressure in the casing. As engineered by Otis, this completion permits the lower zone to be produced through the annulus and the upper through the tubing — saving the cost of a second string of tubing and a dual packer — and at the same time affords a full-opening tubing string for obtaining bottom hole pressures, etc. The flow pattern of the two zones may be reversed if desired simply by changing chokes in the cross-over assembly.





Shown here are trained Otis service specialists rigging up to snub production equipment into a well under pressure. All equipment is hydraulically operated and well pressure is under control throughout the entire operation

The technique of snubbing pipe and downhole production equipment in and out of oil and gas wells under pressure was developed by Otis 32 years ago. It has proved its economic advantages — as in the case of this operator — time and time again. The work is done by trained Otis specialists with unparalled experience in this type of work. For a detailed description of Otis' Snubbing Service, and the packers and cross-over equipment used in these wells — or for help with any of your well completion problems, call the Otis office nearest you or write Otis, Dept. 2-P, Box 35206, Dallas 35, Texas. Experienced Otis specialists are ready and anxious to provide you with a "packaged" well completion service.

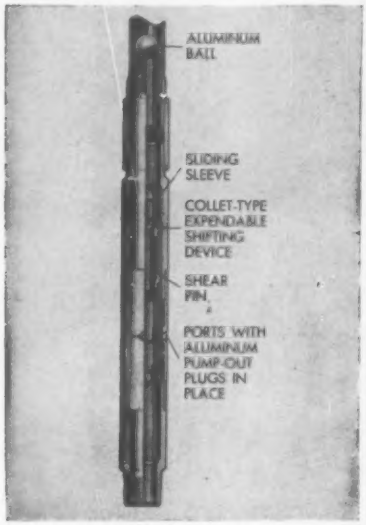
©1960 O.E.C.

Better Production Tools Through Research

New Otis Tool Provides Additional Blowout Protection—Cuts Completion Costs

BELLE CHASSE — Operators in this area are using a new version of the Type A Otis Sliding Side-Door to complete their high pressure wells with greater safety and economy. This tool permits them to run high differential type drillable packers and nipple up the tree before unloading the well during completion operations. This makes possible a completion technique which allows the operator to keep his well under control throughout the entire operation. It also eliminates the need of having a wire line service unit on location and the problems encountered when performing wire line work in heavily weighted fluids.

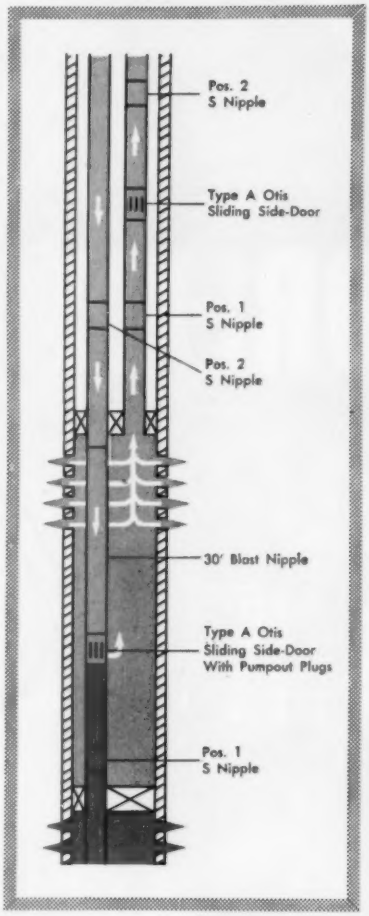
This new version of the Sliding Side-Door® is designed to be run into the well on the tubing with the sleeve opened. Tapered aluminum plugs inserted in the ports of the tool's outer mandrel serve to prevent communication from the casing annulus to the tubing until the well is to be circulated. A special collet type expendable shifting device is located in the upper recesses of the tool's sliding sleeve. This shifting device is designed to catch an aluminum ball or drop plug that is pumped down to close the side-door. (See illustration below.)



Type A Otis Sliding Side-Door with pump out plugs and expendable shifting tool in place.

The technique made possible through use of this new tool is both simple and sure. One of several ways the tool is being used is as shown in the accompanying schematic. The new model Sliding Side-Door, with special pump out plugs in the ports, is made up in the long string and located between the two packers. A standard Sliding Side-Door is located in the short string above the top packer for use at a later date. With this equipment in the well, packers may be tested by pressuring up on the short string. Blowout preventers are then removed and the tree installed with mud in the hole.

Once all provisions have been made to bring in the well, pressure is applied to the long string to dislodge the pump out plugs and mud is circulated out of the well through the short string. Approximately 400 pounds' differential pressure is all that is required to dislodge the plugs. Once mud has been displaced, the sleeve in the Sliding Side-Door may be shifted to its closed position by pumping down an aluminum ball or drop plug. The design of the expendable shifting mechanism in the Sliding Side-Door is such that when the sleeve reaches its fully closed position the collets on the expendable shifting tool release and the shifting device can be pumped out of the bottom of the tubing. After the Sliding Side-Door has been closed, it may be reopened for circulation or production at any future date by standard wire line methods. In the closed position, both V-type packing and O-rings act to provide a positive seal between the sleeve and outer mandrel of the tool.


Pos. 2 S Nipple
Type A Otis Sliding Side-Door
Pos. 1 S Nipple
Pos. 2 S Nipple
30' Blast Nipple
Type A Otis Sliding Side-Door With Pumpout Plugs
Pos. 1 S Nipple

The Otis Sliding Side-Door, with special pump out plugs, was designed and built to help operators reduce their costs when completing wells offshore and in inland water locations. However, the tool has proven so successful in this usage that several major companies have adopted both this new tool and completion technique as a standard operating procedure for all their high pressure wells.

Perhaps you are faced with completion and downhole production problems with which your local Otis specialists can help you. If so, call them today. For more information on the new Type A Otis Sliding Side-Door with pump out plugs or for help with any completion problem, call the Otis Office nearest you or write Otis, Dept. 2-P, Box 35206, Dallas 35, Texas. You'll find experienced Otis well completion specialists ready to help you — anxious to serve you.

New Otis Catalog Serves As Well Completion and Wire Line Service Guide

A new 116-page multicolored catalog of production equipment and services has just been published by Otis Engineering Corporation and is available upon request.

The new catalog contains drawings, operating diagrams, installation schematics, descriptive material, and complete dimensional data on more than a hundred different Otis tools — some of which have never been cataloged before. The catalog is divided into six sections to help the user find any piece of Otis equipment, or any one of their special services, easily and quickly. The sections cover Safety Equipment, Gas Lift Equipment, Completion Equipment, Post-Completion Equipment, Special Services, and Service Tools. Each section contains a concise preface describing the different types of equipment or services covered by that section and where and when the equipment or service should be used. The catalog has an index by sections, and is indexed and cross-indexed alphabetically by tool.

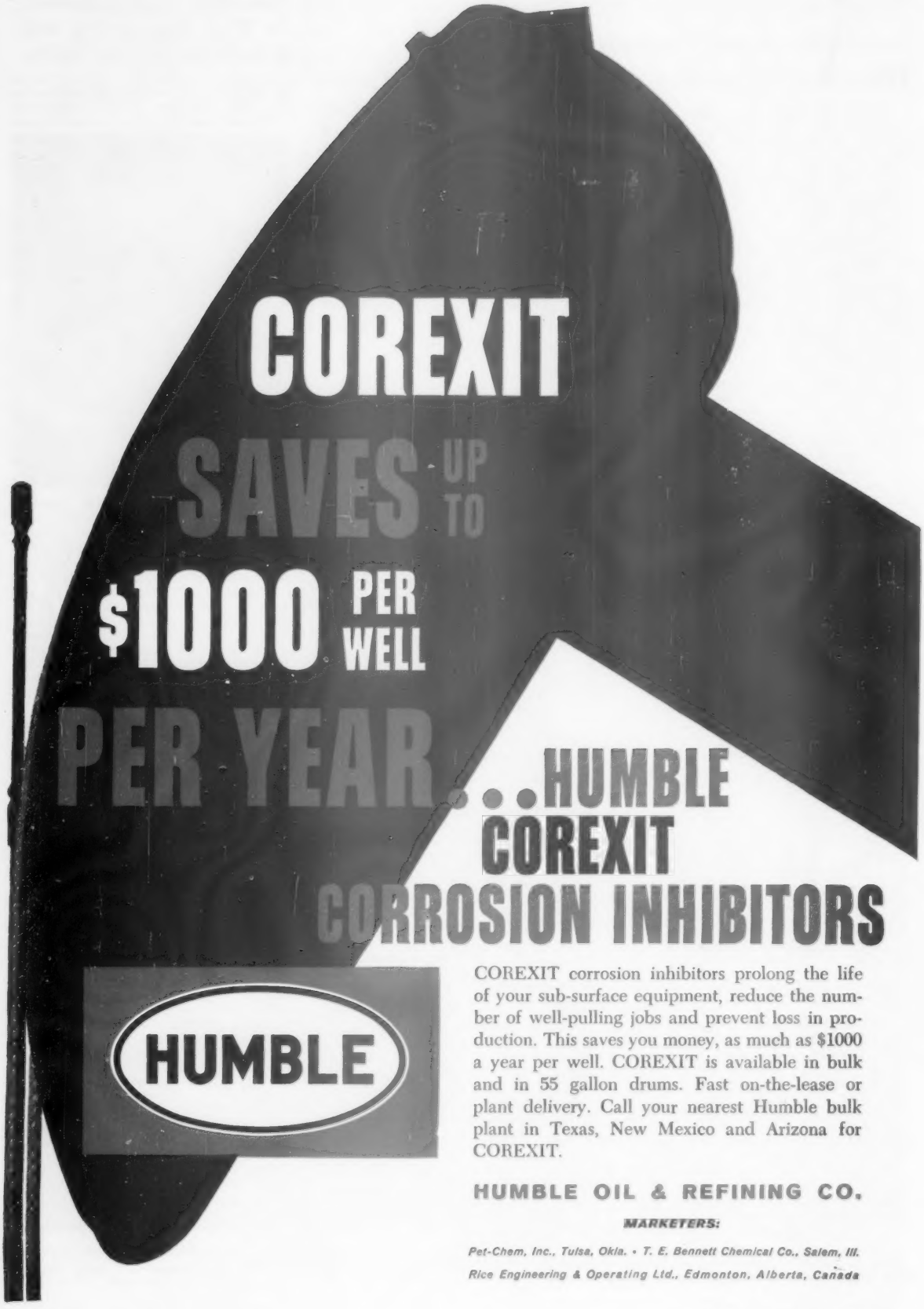
This new catalog will serve as the Otis section of the 24th (1960-61) Edition of The Composite Catalog, however those interested in obtaining a copy for their own personal use may do so by writing Otis Engineering Corporation, Dept. 2-P, Box 35206, Dallas 35, Texas.

OTIS

Engineering Corporation

General Offices:

6812 Denton Drive • Dallas, Texas



COREXIT corrosion inhibitors prolong the life of your sub-surface equipment, reduce the number of well-pulling jobs and prevent loss in production. This saves you money, as much as $1000 a year per well. COREXIT is available in bulk and in 55 gallon drums. Fast on-the-lease or plant delivery. Call your nearest Humble bulk plant in Texas, New Mexico and Arizona for COREXIT.

HUMBLE OIL & REFINING CO.

MARKETERS:

Pet-Chem, Inc., Tulsa, Okla. • T. E. Bennett Chemical Co., Salem, Ill.

Rice Engineering & Operating Ltd., Edmonton, Alberta, Canada

"BROWN CAM-LOK" PROFIT PACKING PACKER

It's a fact the Brown Cam-Lok does more for your money – packs more profit when production totals are in.

Here's why:

Use Cam-Lok as a packer during the flowing life of your well. When the well goes on the pump, convert Cam-Lok to a tubing anchor while you are working over the well and run it back. Thrifty? You bet it is!

and positive, too . . .

Cam-Lok is the most controllable mechanical packer you can put in your well.

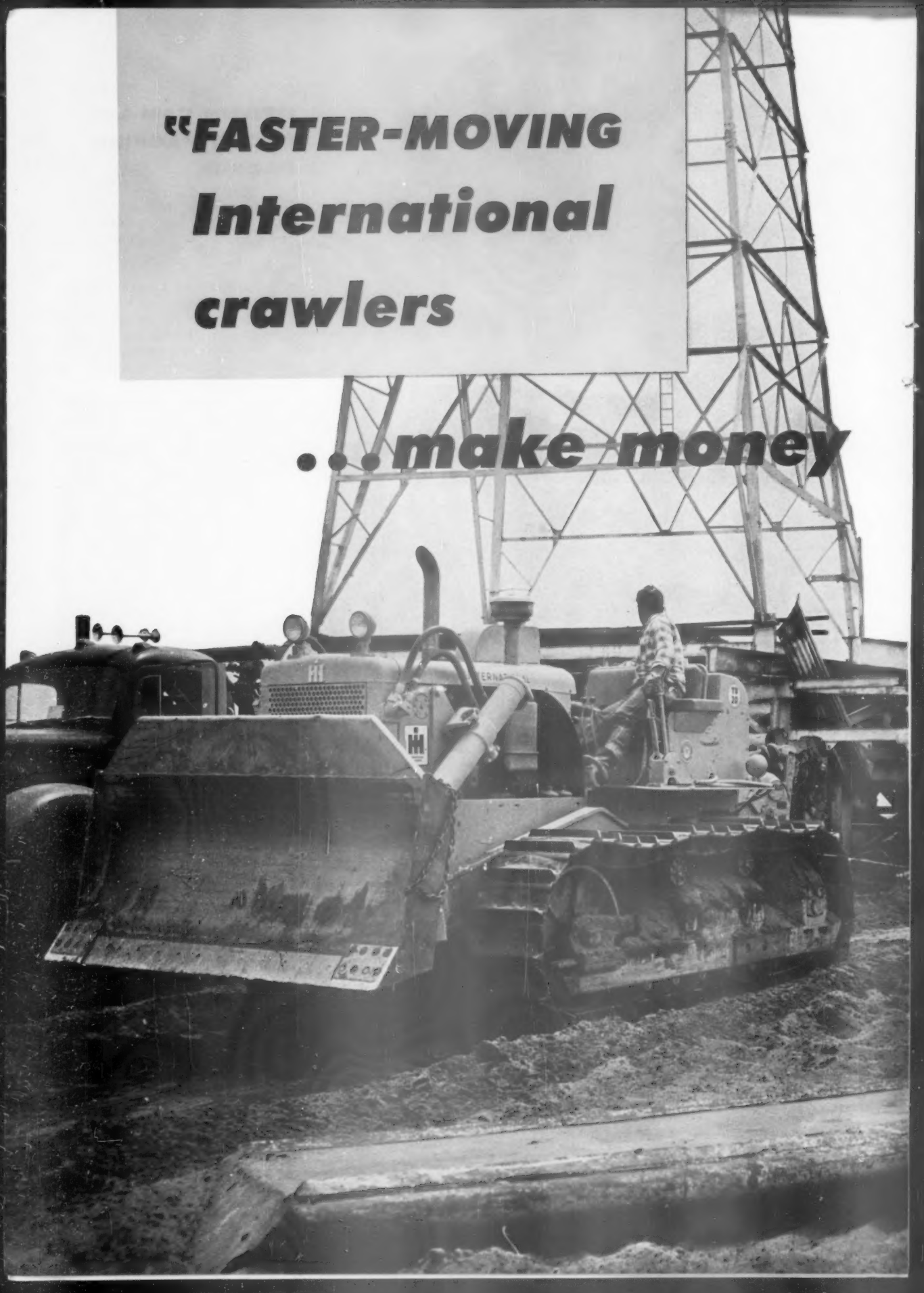
Less than one quarter turn of the tubing in either direction operates the unique Brown cam mechanism, to grip the casing like a pipe wrench working from the inside. This wrench grip, not friction springs or blocks, will lock the packer in place as long as torque is held in the tubing – to permit lifting or slack-off of the tubing to set or release the packer. Cam-Lok is the industry's best insurance against failure of a packer to release.

and it's simple to operate . . .

Cam-Lok is a tough, compact, full-opening, retrievable, reliable tool. In its simplest application, Cam-Lok is used as a weight set packer. Cam-Lok is set in tension to take advantage of pressure from below when testing, water flooding, fracturing, acidizing, or in shallow wells where the tubing weight and casing fluid column may not be sufficient to hold the packer weight-set against high bottom hole pressure.

Call the nearest Brown representative for full details and pack more profit in your next completion with the versatile, thrifty, positive Brown Cam-Lok Packer.

BROWN
OIL TOOLS, INC.
8490 Katy Road · Houston, Texas


"FASTER-MOVING
International
crawlers
. . . make money

"My International crawlers move faster on setting up or taking down rigs, and other lease location jobs," states D. E. McCain for his rig company. "I know these crawlers save time and make me money doing jobs faster (than other outfits)."

Here's the newest member of his fleet: The TD-20. Its engine is a high-torque 134-hp Diesel—with International Diesel starting ease and operating economy.

"Single-stick" shift—Shuttle-Bar Control! You match speeds exactly to working conditions with the TD-20's 6-speed, full-reverse transmission. Change gears and change forward-reverse directions with one fast hand sweep of the "single-stick" shift, and the Shuttle-Bar control lever.

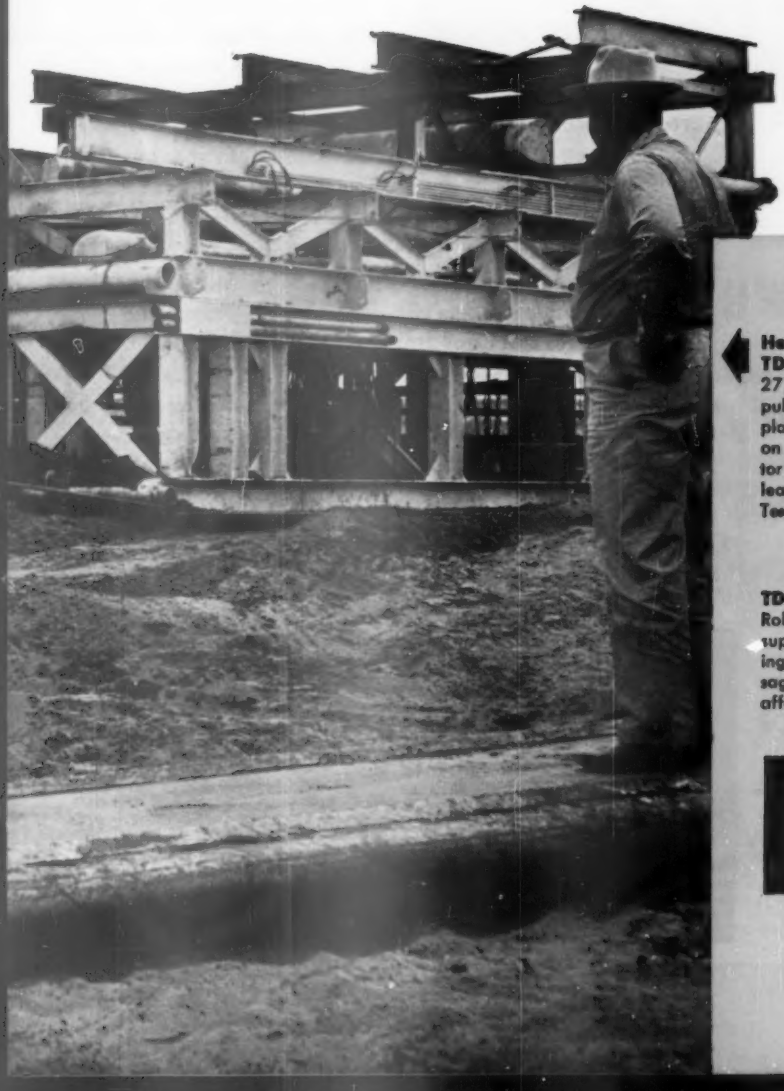
You get the high power transfer efficiency and built-in heat-defiance of International's sintered-metal-faced engine clutch—in the TD-20. This simplified design increases TD-20 "get-aroundability" and big capacity; also simplifies maintenance!

Bridge-strong track frames of heavy-duty, gusset-braced, welded box sections form the TD-20's shock-resistant undercarriage. Exclusive International 3-point mounting allows free track oscillation for rough oilfield duty—and maintains positive, life-prolonging alignment.

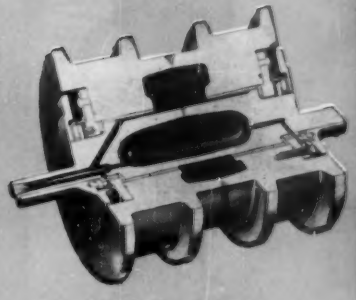
Compare TD-20 performance to anything else its size on tracks—for capacity, economy, and long life. Measure the "20's" cycle-speeding fast-acting controls that give full advantage of six speeds forward and reverse. See your International Construction Equipment Distributor for a demonstration.

doing jobs quicker"

—D. E. McCain Rig Co., Midland, Texas



Here's D. E. McCain's TD-20 ready to apply 27,500 lbs. of drawbar pull—to position a 40-ton platform fast, for loading on a truck. This contractor specializes in location lease work in the Odessa, Texas, field.



TD-20 weight rides smoothly on International Dura-Rollers that feature the industry's thickest shells for super strength; king-sized lube reservoirs; and full-floating, precision-lapped seals. Exclusive pressure relief passages let you power-lubricate Dura-Rollers without affecting seal life or efficiency.

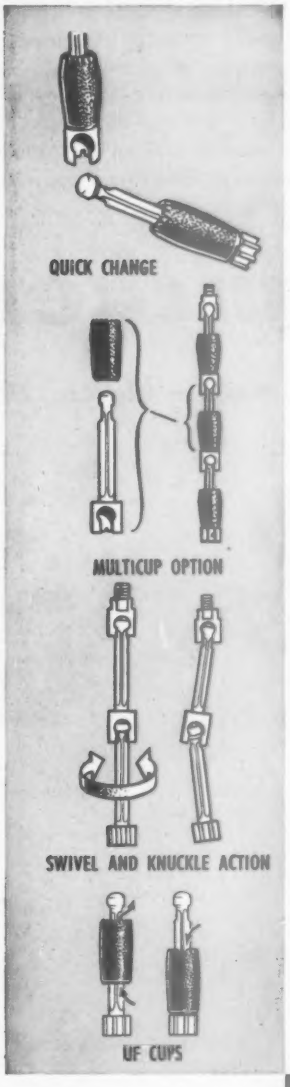
International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

CUT COSTS.. SPEED-UP SWABBING with NEW

GUIBERSON Knuckle Joint Tubing Swab

and SENSATIONAL MULTI-PURPOSE UF CUPS



QUICK CHANGE — New ball-and-socket design, another Guiberson first, lets you change cups in *ten seconds* with the swab hanging on the line . . you don't even have to lay the swab and sinker bars down. No pipe wrenches or other tools are required. This one feature reduces cost tremendously . . but that's not all . .

MULTICUP OPTION — Add a cup and upper mandrel . . as many as desired. No need to carry several different swabs . . no time lost in changing swabs. There are only five parts in a two cup swab . . sub, cups, upper and lower mandrels. Heat-treated steel parts are individually tested to withstand heaviest swabbing loads.

SWIVEL AND KNUCKLE ACTION—You get full 360° swivel at the bottom socket joint and 5° knuckle action at every joint. With any number of cups and even in crooked tubing, the combination of knuckle action and ample bypass makes this the fastest-falling swab ever run.

UF CUPS — Are strong, flexible, long life . . made from special compound with a valve ring molded in the base. Thus, new valves are obtained each time the swab is redressed. Cups travel freely on the mandrel, allowing bypass inside and outside the cup in the up position . . sealing perfectly in down position. The UF cups, designed especially for the knuckle joint swab, are strongly reinforced for heavy loads . . flexible enough for light loads . . small enough for tight tubing. Use the knuckle joint swab with UF cups and lift more fluid in fewer trips.

SAVE MONEY ON YOUR NEXT JOB WITH THIS SWAB

Sold by OIL FIELD SUPPLY STORES EVERYWHERE

SAFE THAN SORRY BETTER BE GUIBERSON

THE

GUIBERSON

CORPORATION

ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.

CB&I creates a giant in Kuwait!

CB&I is building the world's largest floating roof tank for American Independent Oil Company, in Mena Abdulla, Kuwait, Arabian Gulf. The tank—to be constructed by Chicago Bridge Limited—will measure 260 ft. in diameter and 64 ft. in height. It's a task even Aladdin and the mystic genie of the lamp would have considered most difficult. No problem, however, for CB&I's world wide *Coordinated Services* in engineering, fabrication and erection.

Within the tank shell, a Horton pontoon floating roof equipped with a Horton fabric seal will ride the surface of the product. By eliminating vapor space in the tank, it will reduce evaporation loss, decrease corrosion and minimize fire hazard.

Big job? Tough job? CB&I "can do."

CHICAGO BRIDGE & IRON COMPANY

332 SOUTH MICHIGAN AVENUE
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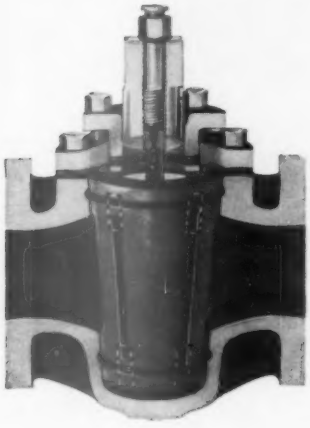
OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

the idea:

Simplicity Is Basic To Efficiency and Economy

One of the world's first valves, plug cocks invented by the Chinese centuries ago, had only one moving part—the plug. Even the earliest craftsman recognized the fact that simplicity of design almost always means a device that works better, lasts longer and costs less to use.

the application:



How It Helps Give You A Better Valve

In the modern Rockwell-Nordstrom lubricated plug valve there are only three rugged, basic parts . . . plug, body and cover. The plug is the only moving part. Compared to other valves, nothing could be simpler or more efficient. Yet the many advantages of simplicity are actually multiplied by *lubrication* in these valves. Pressurized lubrication jacks the plug, keeping it free for instant ¼-turn operation. It also forms an instantly replaceable, impenetrable seal against leakage, and prevents metal-to-metal wear.

the benefits:

Longer Valve Life At Lower Cost . . . Leak-proof Sealing . . . Reduced Down Time . . . Completely Protected Seating

The 6 million Rockwell-Nordstrom lubricated plug valves now used in a wide variety of industries are translating these benefits into dollars and cents savings day after day. Rockwell-Nordstrom is the most complete line of lubricated plug valves (sizes from ½" to 36"; pressures to 15,000 lb), lubricants and operating accessories. For *practical* help in solving your flow control problems, see your supplier or write: Rockwell Manufacturing Company, Dept. 92G Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited. If you live outside the U. S. or Canada, write: Rockwell International, S.A., Geneva, Switzerland.

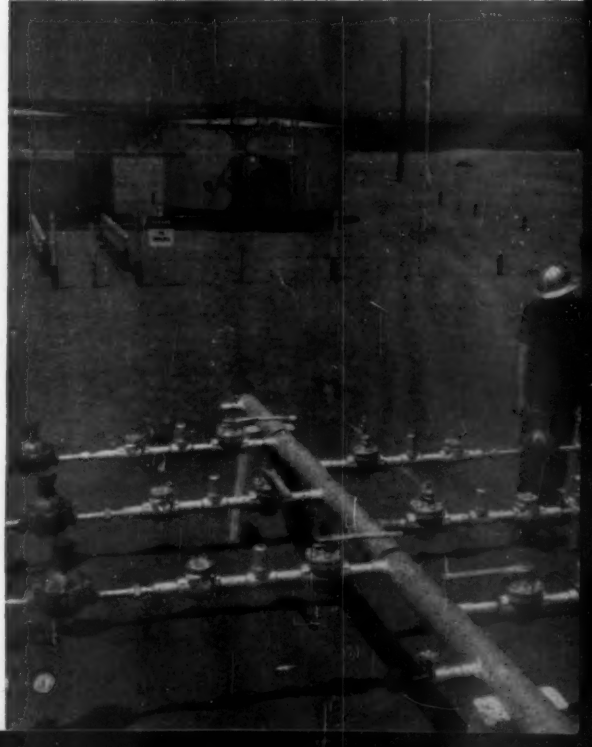
Lubrication Makes The Difference

ROCKWELL-Nordstrom VALVES

another fine product by

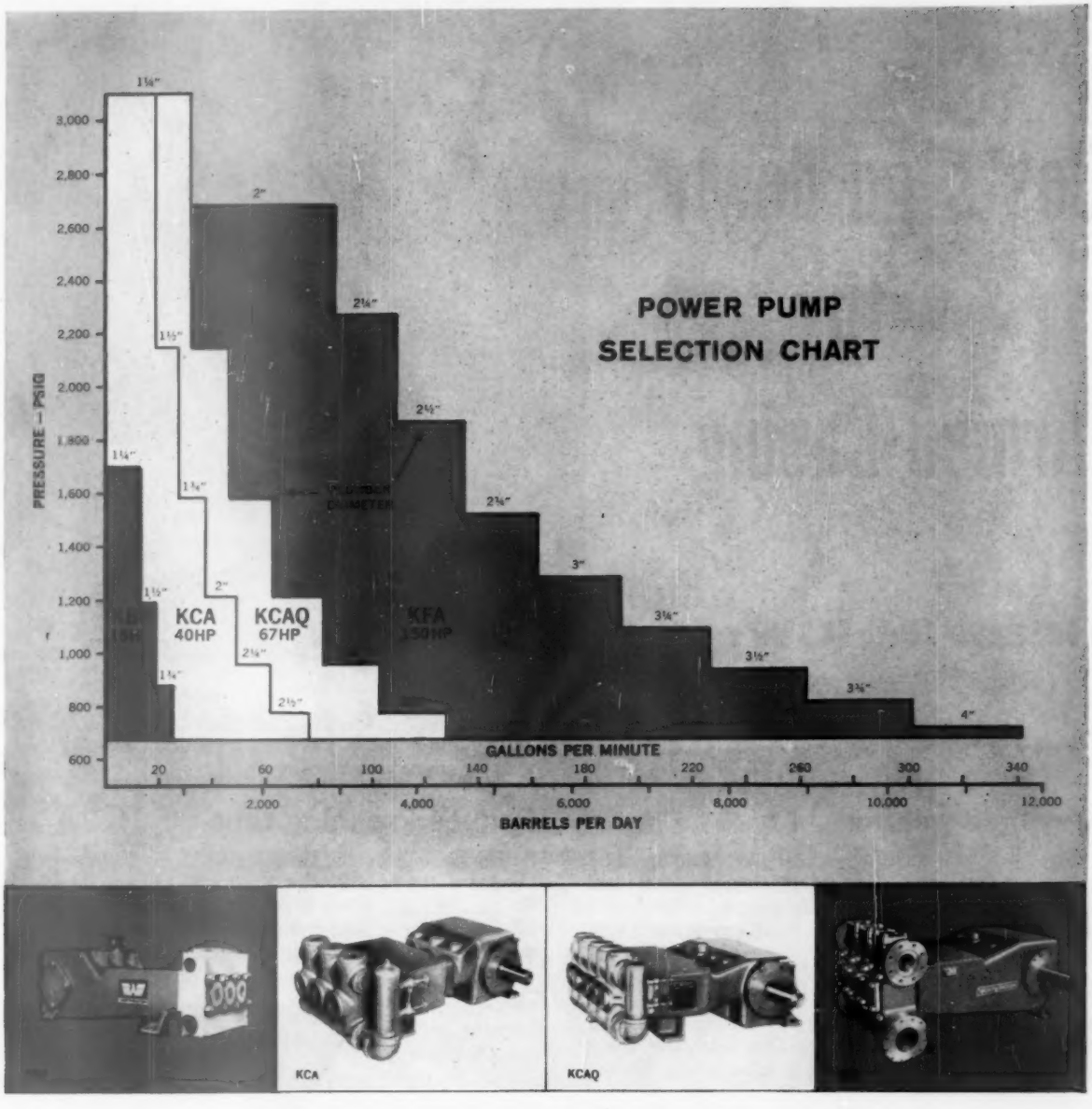
ROCKWELL

Rockwell-Nordstrom valves resist punishment of water flooding operations, assure perfect control. (Rockwell 5-Pointer water flood meters also shown.)



Visco

CONSISTENTLY EFFICIENT OIL FIELD CHEMICALS



NEW PUMPS EXTEND RATINGS

. . . to make Worthington your lowest cost high-pressure pump

This is the first public announcement of two new Worthington high pressure, reciprocating pumps. With nominal ratings of 15 and 150 hp, they complement existing pump lines rated at 40 and 67 hp. All are horizontal designs which save you up to 53% on initial cost.

These four pumps—each available in several interchangeable plunger sizes—allow you to buy the most economical amount of pump for your particular application. Should you require pumps of more than one rating, you save money on spares because many parts are interchangeable in the Worthington line.

More and more oil producers are choosing Worthington for waterflood applications. A Worthington representative would be glad to explain how this expanded line can save you money on many types of installations.

Get in touch with your nearest Worthington district office. Or write Worthington Corporation, Section 32-8A, Oil City, Pa.

WORTHINGTON

Costs go down with Armco Casing

HERE'S HOW:

There are three basic reasons why Armco Casing means lower costs, greater efficiency.

Fast field welding

The fast, easy-to-make downhand fillet weld required with Armco Casing keeps field welding costs low. Just stab one end of a 40- or 50-foot joint into the Armco Slip-Joint Collar, make a fast weld and lower away.

Low casing costs

High collapse resistance of Armco Casing is uniform throughout, which means you can safely set lighter, lower cost strings to greater depths. Tests have proved that the variation in collapse pressure for Armco Casing is less than for other types of casing.

Reduced running time

Armco Casing, supplied in exact 40- or 50-foot lengths, eliminates the usual random or double-random lengths. Because of fewer joints in the string, you get faster running, lower costs. And uniform lengths help you quickly determine the footage in the hole or in the stockpile at any time.

New steels are born at Armco

Armco Casing is distributed by National Tank Company from the 26 stocking points listed at right. Sizes range from 6 to 24 inches. Write us for complete information. Armco Drainage & Metal Products, Inc., 4440 Curtis Street, Middletown, Ohio.

Illinois
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ARMCO DRAINAGE & METAL PRODUCTS

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Here's the highballing crew that teamed up to pull and stack 6,000 feet of drill pipe in little more than one hour. Superintendent H. T. Love, and crewmen C. R. Williams, R. P. Williams and J. S. Light. Another member of the team—the International V-8 engine—is in the background.

6,000 feet pulled and stacked in 65 minutes with International V-8 engine

The Poole Well Service Co. of Midland, Texas is replacing 2½-inch tubing with 3½-inch for a sand fracturing operation on Humble's T & L lease. Sole power on their Wilson self-propelled servicing rig is an International UV-549 V-8 engine. With this dependable power the normal 4-man crew recently pulled and stacked 6,000 feet of 2⅞-inch drill stem in one hour and five minutes—an average of two stands per minute!

Your equipment, too, will perform more efficiently with smooth, dependable IH power. To adapt the engine to varying oil field requirements, there are fuel attachments for natural gas, combination natural gas and gasoline, and LPG; air compressor (engine mounted); hydraulic steering pump; Selectomatic torque converter or spring loaded clutch transmissions; exhaust condenser; top cylinder oiler; automatic safety shut-off; automatic radiator shutter; magneto ignition and gear driven mechanical governor. Your nearby International Engine Distributor or Dealer can give you product information and installation assistance on the complete line of 35 diesel and carbureted models—16.8 to 385 max. hp.

INTERNATIONAL®
ENGINES

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180 North Michigan Ave.,
Chicago 1, Illinois

A COMPLETE
POWER PACKAGE

POWELL

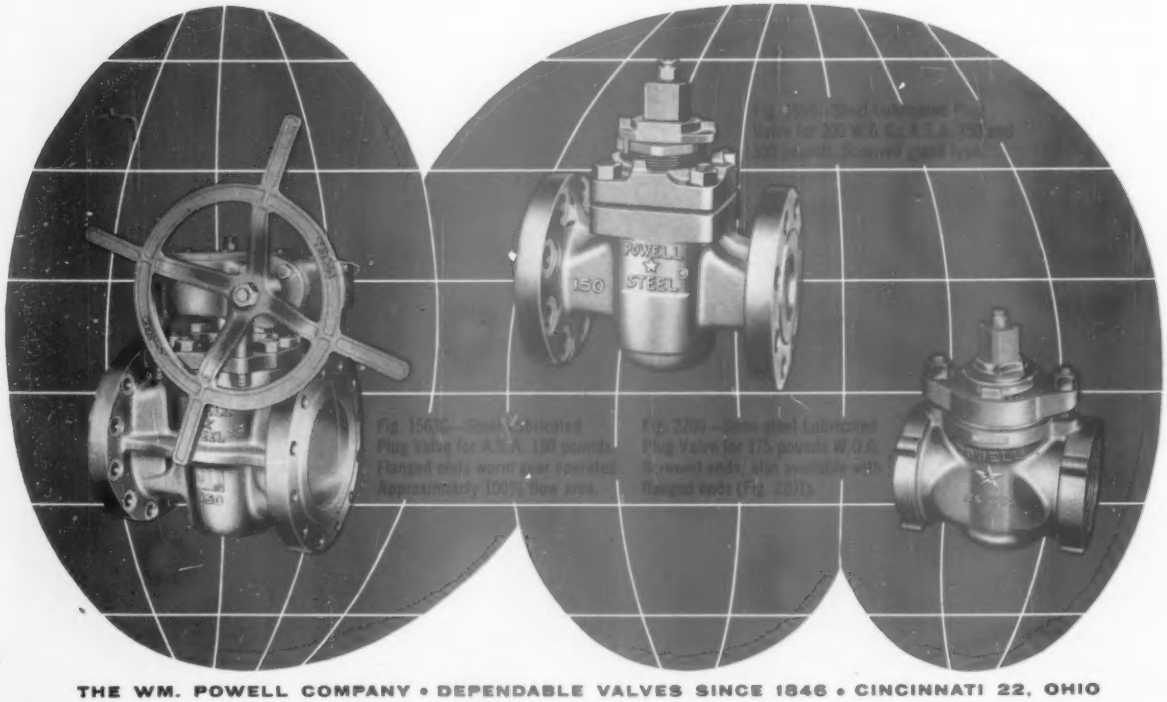
LUBRICATED PLUG VALVES

performance that makes a world of difference

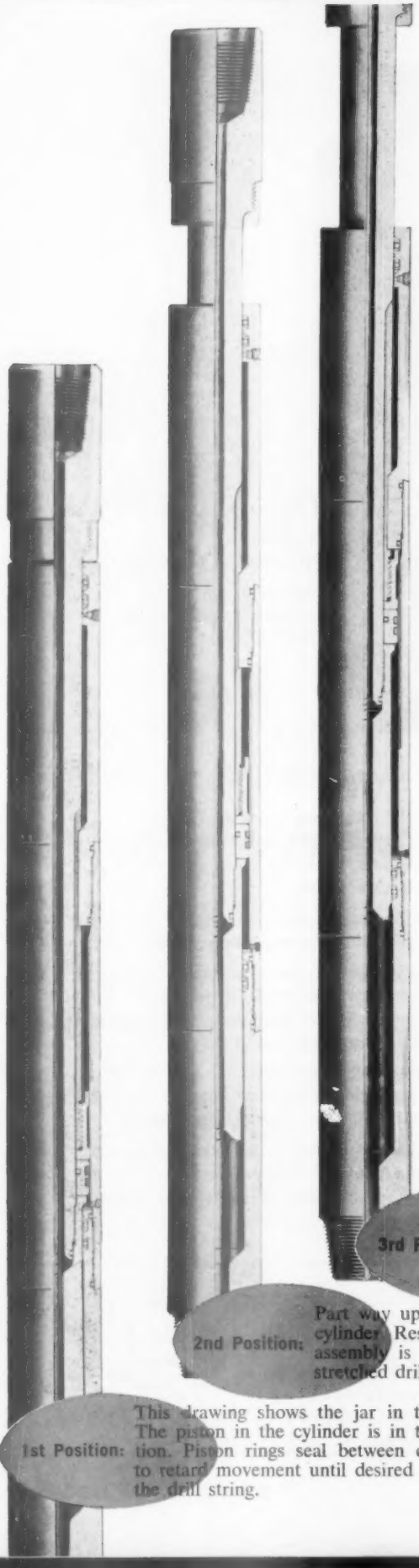
For over a century, Powell has supplied vital valves to the all-important oil industry. Today, the complete line includes valves of all types. Powell has the greatest variety of sizes, designs, pressures and metals. There is one to cover every valve need in oil refineries, petrochemical installations, and storage facilities everywhere.

Powell engineers and metallurgists will gladly make a special analysis of your requirements and submit recommendations to fill all your valve needs. Write directly to us . . . or consult your local Powell distributor.

Powell . . . world's largest family of valves



THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO



For Positive Operation, Long Life and Trouble-free Service use

Bowen HYDRAULIC ROTARY JARS

Here is a straight-pull jar that can be depended upon to deliver a blow of any intensity—from a light tap to the maximum impact that can be withstood by the run-in string. Even more important, it is easily controlled from the surface—no need to take up torque—no surface pre-setting. The impact intensity and frequency are easily and simply controlled by the operator by elevating the drill string at the speed required to strike a blow of the desired intensity.

Key to the outstanding performance is the patented Bowen Seal Ring Assembly which consists of Non-Extrusion Rings, Seal Protector Rings and "O"-Rings. The Seal Ring Assembly enables the Bowen Hydraulic Rotary Jar to withstand extreme differential pressures without failure.

Bowen Hydraulic Rotary Jars have been proved through years of use under all conceivable conditions. They have operated successfully at depths as great as 20,000 feet and temperatures above 390° F. Write for full information.

BOWEN

25th ANNIVERSARY 1935 1960

BOWEN ITCO, INC.
P. O. BOX 4587 • HOUSTON 13, TEXAS

3rd Position: At the upper limit of piston motion, the full energy potential stored in the drill string is available to jar the fish. The intensity of the blow is perfectly controllable, and the jar is easily reset by just setting the weight of the drill string on the jars.

2nd Position: Part way up, the piston enters the fluted section of the cylinder. Resistance to motion drops, and the jar's inner assembly is greatly accelerated by energy stored in the stretched drill string.

1st Position: This drawing shows the jar in the closed position. The piston in the cylinder is in the lowermost position. Piston rings seal between cylinder and piston to retard movement until desired tension is taken on the drill string.

MR. JOE ZEPPA

President,
Delta Drilling Company

President,
American Association of
Oilwell Drilling Contractors

"Initiative, ingenuity and inventive skill."

"Modern drilling programs continue to become more demanding. Deeper wells, higher pressures and temperatures require the Drilling Contractor to have the finest equipment, top-notch crews and, above all, the know-how to drill a good well economically.

"Progress in oil and gas well drilling would have been much slower without a healthy, competitive contracting industry.

"The Drilling Contractors' feverish search for improvement, coupled with today's technological and equipment advances, make it possible to get the job done faster, under more difficult conditions, with a greater amount of success and at a lower cost per foot.

"Much of the credit for this can be given the equipment and service industries whose continual research and development programs have offered solutions to many of the complex drilling and production problems.

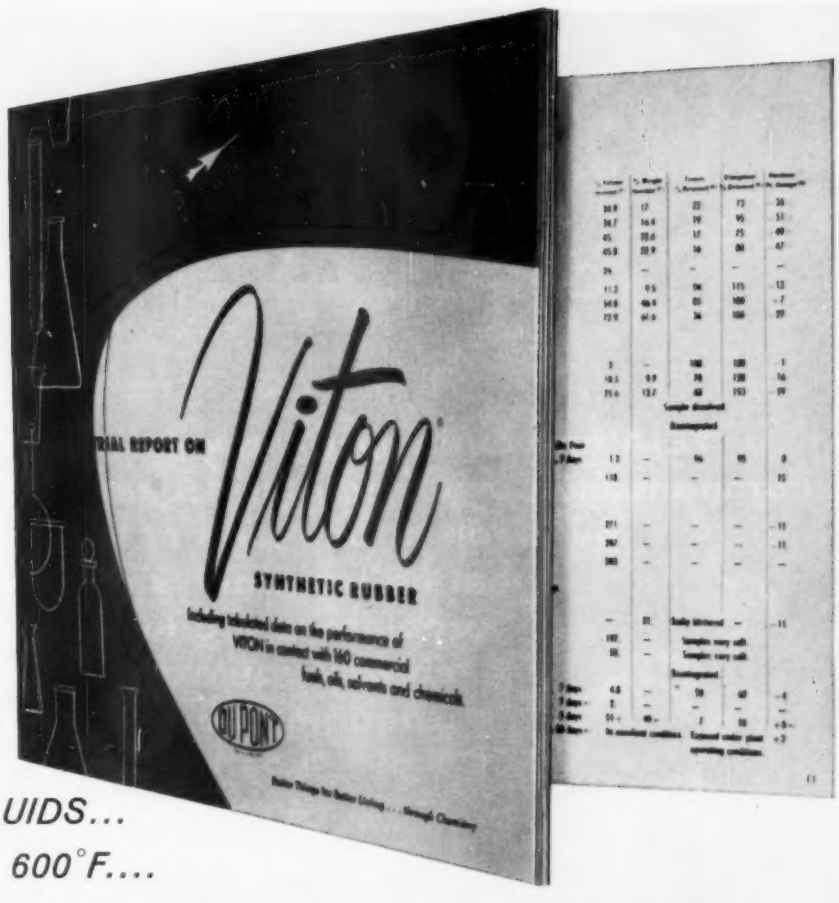
"As a Drilling Contractor, in a highly competitive business, I can attest to the many advances made in our industry. This progress is the result of initiative, ingenuity and inventive skill so typical of the manufacturing, supply and service companies serving us today."

P.E.S.A.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION



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160 DIFFERENT FLUIDS...
AND HEAT UP TO 600°F....

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In a centrifugal heat exchanger, heat-resistant O-rings made of* VITON *outlast other elastomer seals 25 to 1 . . . are unharmed by operation at temperatures as high as 525° F.!

In a refinery valve, seat and O-rings of* VITON *still give positive shutoff after more than a year's service with benzene!

In a tank farm loading system,* VITON *packings have handled a wide range of solvents, both aromatic and aliphatic, for over two years without deforming or losing their resilience!

THESE are just a few of the many industrial applications where VITON synthetic rubber is cutting operating costs, doing jobs no other rubber could do. "Industrial Report on VITON" brings you more examples, plus latest engineering facts and figures on Du Pont's improved heat and fluid resistant elastomer. Here's a brief summary of its contents:

COMPLETE HEAT AND FLUID RESISTANCE DATA—Seals, gaskets, hose and other products made of VITON perform at temperatures from –40° F. to +600° F. "Industrial Report on VITON" gives more details, and outlines VITON's resistance to 160 commercial fluids.

PHYSICAL AND RESISTANCE PROPERTIES—Information is provided on hardness, tensile strength, elongation, compression set, electrical and low temperature properties, as well as resistance to ozone, weather and sun.

This reference booklet should be in *your* permanent materials file. Fill in and mail the coupon below for your copy. For information on specific parts made of VITON, and how they can cut your operating costs, see your rubber goods supplier. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department OG-7, Wilmington 98, Delaware.

----SEND FOR YOUR COPY NOW------

Elastomer Chemicals Dept. OC-7
E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware

Please send me a copy of
"INDUSTRIAL REPORT ON VITON SYNTHETIC RUBBER"

Name _____
Title _____
Firm _____
Address _____
City _____ State _____

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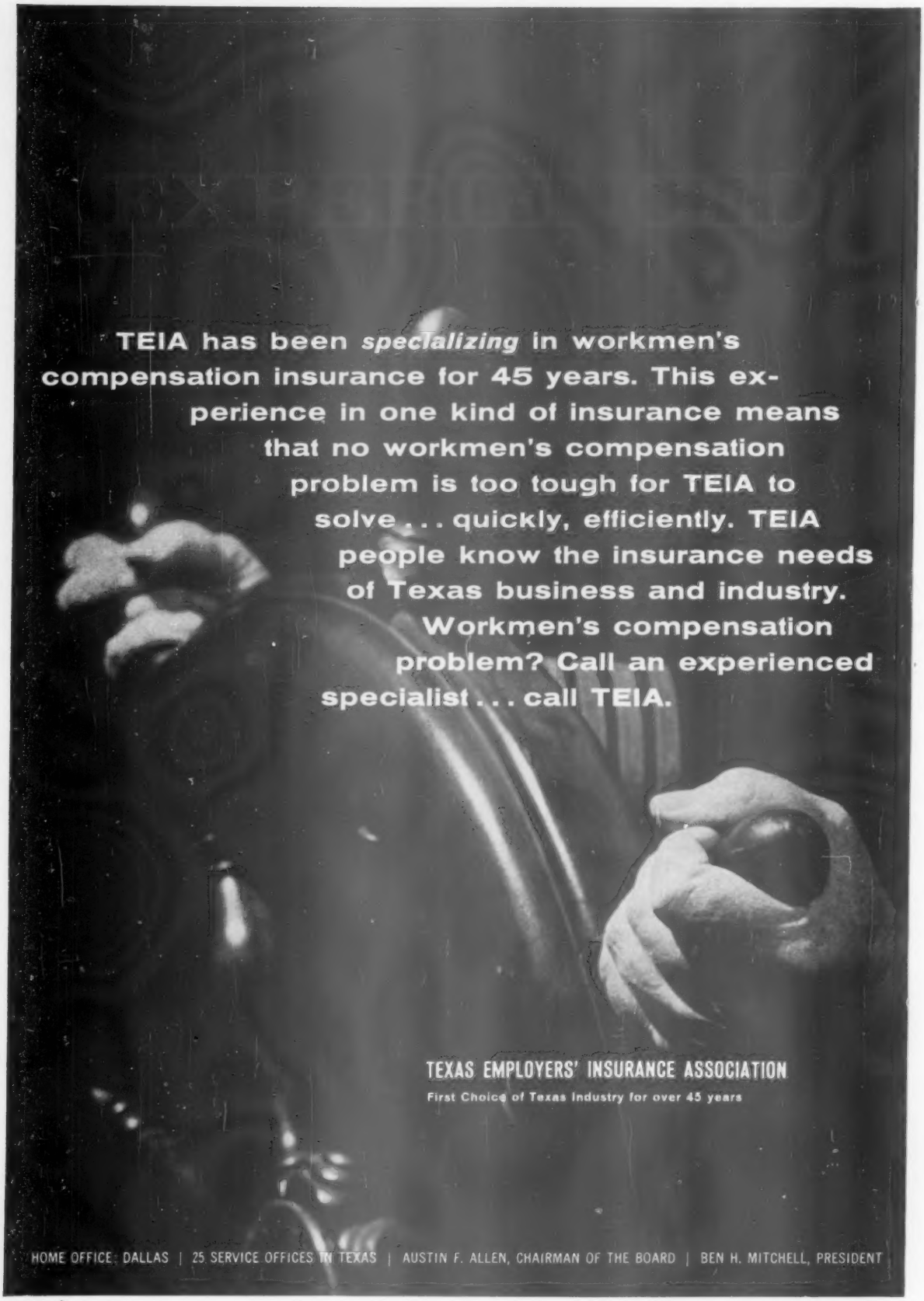
REG. U. S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*

SYNTHETIC RUBBER
NEOPRENE HYPALON® VITON® ADIPRENE®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ALSO SPEEDS AIR SWEETENING...

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It is equally potent in preventing gum formation and TEL decomposition. But for stubbornly sour gasoline, No. 5-S has the edge—can bring about completion of sweetening reaction in three-quarters to one-quarter of the time.

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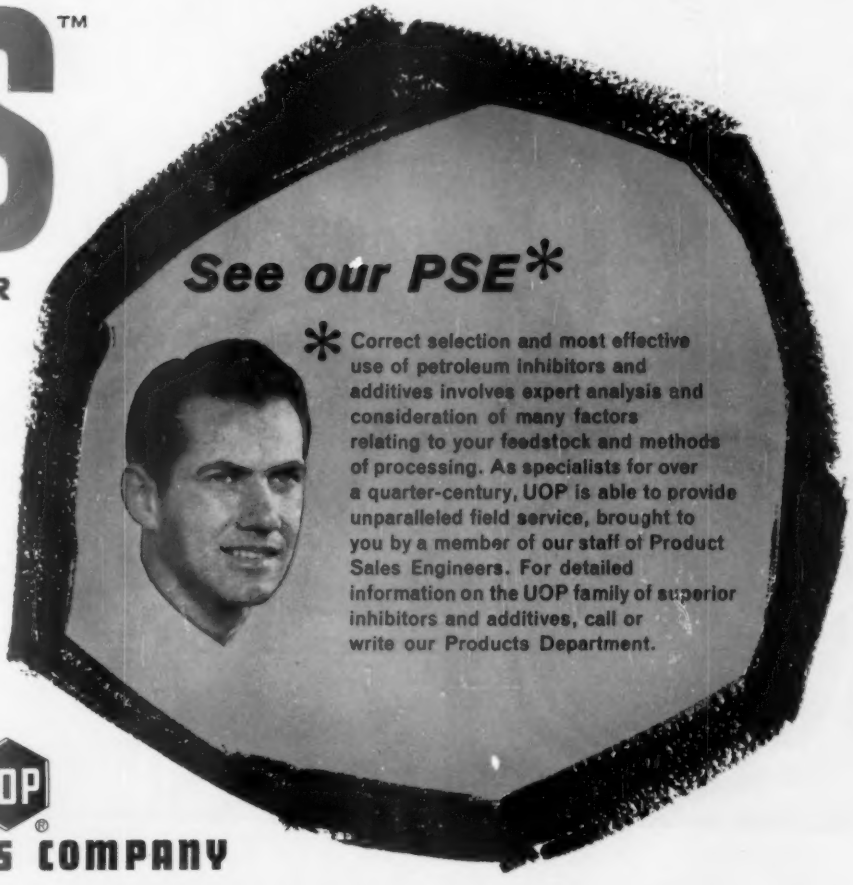
UOP No. 5-S™ INHIBITOR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* Correct selection and most effective use of petroleum inhibitors and additives involves expert analysis and consideration of many factors relating to your feedstock and methods of processing. As specialists for over a quarter-century, UOP is able to provide unparalleled field service, brought to you by a member of our staff of Product Sales Engineers. For detailed information on the UOP family of superior inhibitors and additives, call or write our Products Department.

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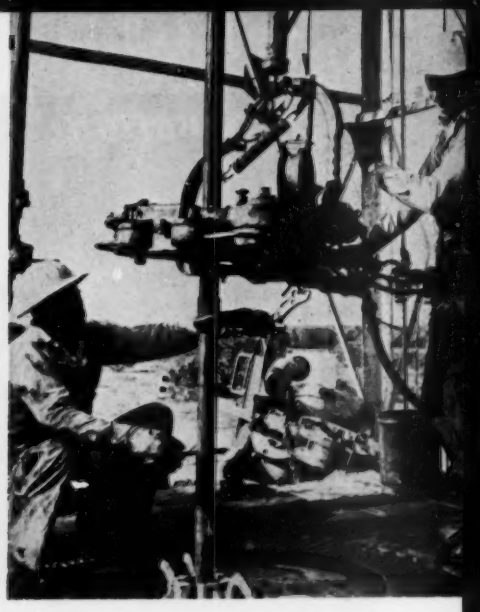
In production equipment, quality is the only key to extra service, reduced final costs....

Quality Equipment Cuts Costs

Cabot Catalog 60 gives you complete specifications on the new Equalign and the Equalastic Adjustable Crank Balanced Series and the Beam Balanced Series. Each Cabot Series has advantages worth your study and consideration; advantages based on minimum maintenance and dependable performance. Call your J&L Supply man for complete information.



J&L Tubing (upper right) plus Axelson Bottom Hole Pumps and Sucker Rods point the way to production economy. The extra service and reduced maintenance of quality equipment assure lower real costs.

J&L offers a complete line of casing and tubing, including special designs for problem production.

Fast dependable service is available from J&L pump shops to back up your investment in quality.

Our Shreveport district office and store (below) is one of many well stocked locations ready to serve you. For quality equipment to cut your real costs ... see your local J&L man ... and save.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

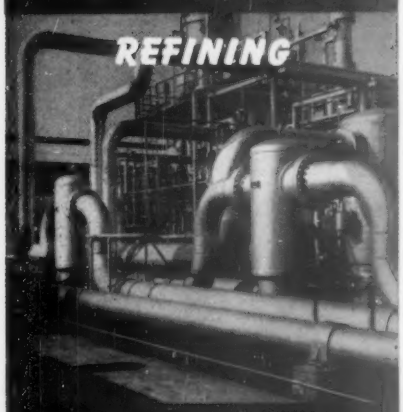
If it's sold by J&L....
It's the best available

110

PRODUCTION

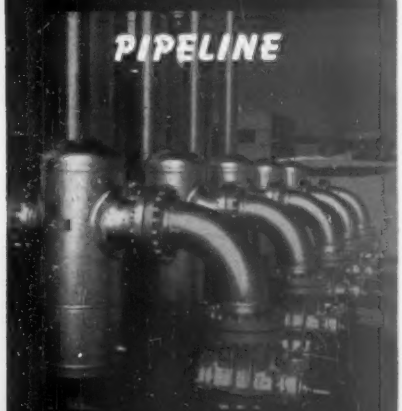
Pictured above is a Peerless Line Separator removing moisture from fuel to drilling rig.

REFINING



These two Peerless Line Separators are doing an efficient job of mist extraction in the Petrochemical plant in Kentucky.

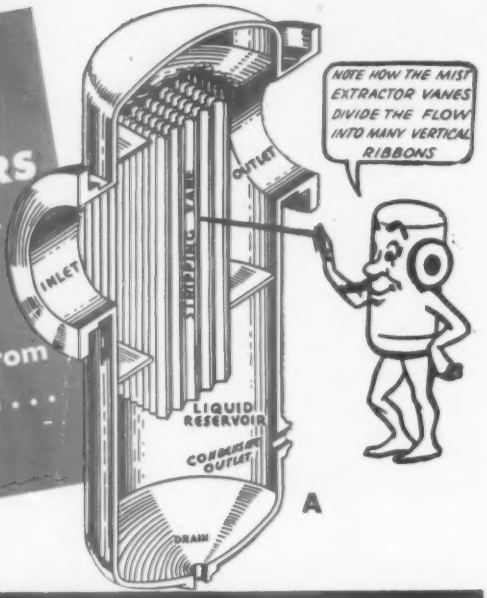
PIPELINE



FIVE Peerless Line Separators are shown above as they handle carry over from large scrubbers.

PEERLESS LINE SEPARATORS

Outstanding for the efficient extraction of liquid mist from gas or steam . . .



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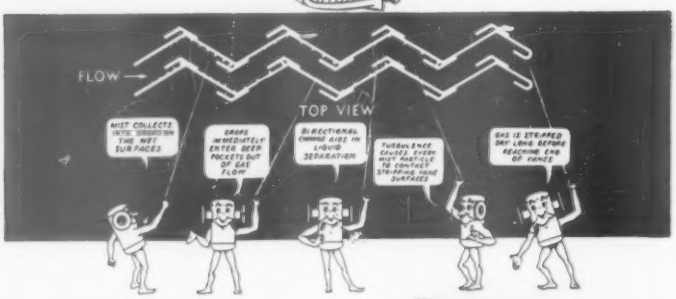
FLOW
TOP VIEW
MIST COLLECTS INTO GLOBULES ON THE WET SURFACES
DROPS IMMEDIATELY ENTER DEEP POCKETS OUT OF GAS FLOW
BI-DIRECTIONAL CHANGE AIDS IN LIQUID SEPARATION
TURBULENCE CAUSES EVERY MIST PARTICLE TO CONTACT STRIPPING VANE SURFACES
GAS IS STRIPPED DRY LONG BEFORE REACHING END OF VANES

B

HIGH EFFICIENCY—HIGH CAPACITY LOW PRESSURE DROP

Thousands of installations throughout the oil industry . . . production, pipeline, refining and petrochemical . . . prove the Peerless Line Separator principle to be one of the most outstanding methods available for the extraction of liquid gas, steam or air.

Drawing A above shows the arrangement of the vanes in the Separator. Drawing B is an illustration of the Peerless Principle.

The mist extractor combines the forces of impingement, centrifugal motion and surface tension to obtain its high efficiency. The path of the gas, etc., through the unit is constantly bending causing semi-violent turbulence and rolling of the gas against the walls of the vane. Impingement and centrifugal force combine to contact the droplets with the vanes, where they coalesce, and surface tension then causes them to cling to the vane's surfaces. Gravity and the impact of the gas steam then drive the droplets into the pockets where they roll down the vanes and out of the gas stream.

Through the Peerless method of mist extraction, the gas is stripped dry long before reaching the end of the vanes.

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For any capacity
For any working pressure
For corrosive conditions
With removable vane units
With extra body length
With connections for accessory equipment
For pressure drop requirements of less than 6" water
For any vapor-liquid ratio
For any piping requirement

SPECIAL DESIGN SEPARATORS FOR ANY REQUIREMENT

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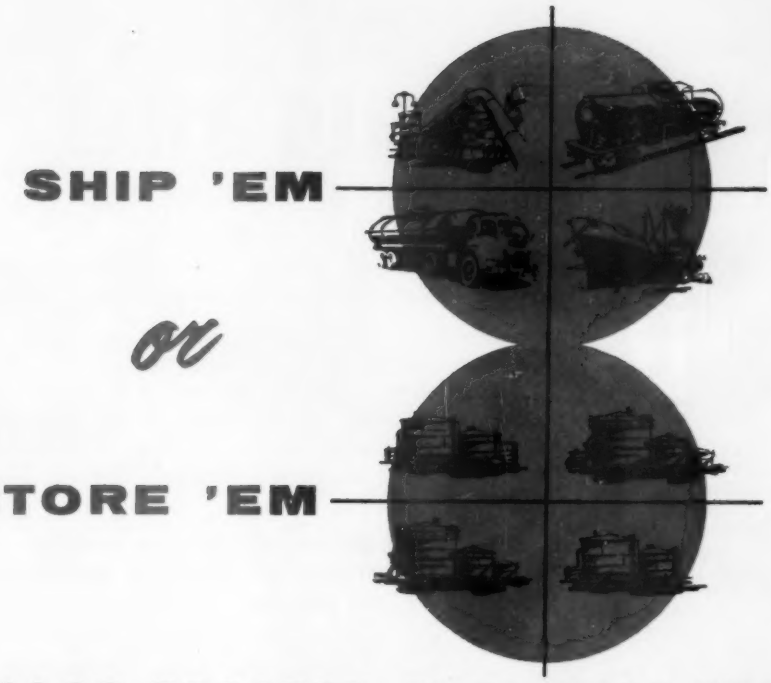

NALCO-TREATED FUEL OILS STAY FRESH!

Get rid of the hurry-up-and-sell pressure caused by unstable fuel oils that darken and sludge up when stored or shipped any distance. New Nalco 303-AC is the fuel oil dispersant-stabilizer that gives you *best* control of sludging tendencies—keeps fuel oils refinery-fresh, bright, and sludge-free even when shipped thousands of miles and stored for months.

Ask for product information on this new chemical for distillate fuels. It is available promptly from your Nalco Representative, or from Nalco direct.

National Aluminate Corporation is now

NALCO CHEMICAL COMPANY • 6242 West 66th Place, Chicago 38, Illinois

Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany
In Canada—Alchem Limited, Burlington, Ontario

Fuel oil at *left* is fresh from refinery, bright and clear. *Center*, Nalco-treated oil is bright and sludge-free after four months. *Right*, untreated sample in four months time has darkened considerably, already begun to sludge.

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Nalco CHEMICALS

Here's how one operator

SAVED 5 DAYS RIG TIME

with new Johnston tool!

"The Johnston Selective Zone Tester saved us five days rig time!"
Mr. Ernie Walker, Drilling Superintendent, Calvert Drilling Co.

The Jordon #1 was drilled by Calvert Drilling Company in Dewey County, Oklahoma and bottomed at 11,000 feet.

Drilling the well accomplished only part of the job. Now it became necessary to evaluate all possible producing zones and complete this well if it proved commercially productive. Just as during drilling operations, any delay in evaluation is costly. An idle rig, inoperative tools, equipment breakdown, needless action—all mean lost dollars.

The job of determining subsurface formation conditions was given Johnston Testers. **A total of nine Selective Zone Tests were run:**

Test interval—9534 to 9550 feet. Dual packers top and bottom. Used Johnston Selective Zone Anchor. Good test! Released tool, picked up 8 feet to interval 9526 to 9542 feet. Re-set tool. Another good test!

Test interval—9564 to 9685 feet. Dual packers top and bottom. Used Johnston Selective Zone Anchor. Formation failed to support mud weight. **Picked up tool and re-set seven times at different intervals.** Anchor worked perfectly, did not slide at any time!

The ability to set, release and re-set the Selective Zone Anchor allowed testing of many zones with just one trip in the hole. Extra time was saved since long tailpipe did not have to be run.

Selective Zone Testing with the new "CO" Combination Shut-In Hydraulic Tester and the new Selective Zone Anchor can save you money, too! Call Johnston Testers and learn why you get more from a Johnston Test!

JOHNSTON TESTERS, INC.

P. O. Box 98 Houston 1, Texas

Valuable blending services available to Du Pont tetraethyl lead customers

When the familiar yellow and green Du Pont tank car rolls onto one of your blending plant sidings, you're taking delivery of more than a shipment of tetraethyl lead—for the services that go with it can be as valuable to you as the antiknock compound is to the quality of your gasolines.

For example, if you're planning continuous in-line blending of gasoline components, Du Pont men are ready to help you with their experience. If you're planning a more modern blending plant, our operations group will be glad to assist your engineers in developing and perfecting its design.

In addition, special services are available for blending plant construction and operation, including, for example, site selection and the training and medical examination of blending plant personnel.

But comprehensive blending plant service is just one example of the many services available to Du Pont tetraethyl lead customers. Your Du Pont Petroleum Chemicals representative will be pleased to discuss them with you. For more information, contact him or write to E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

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. . . through Chemistry

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Petroleum Additives

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*A SUBSTANTIAL INCREASE IN PROCESS CAPACITY will be needed by 1962, according to reliable estimates... NOW is the time to start your planning!

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One thing petroleum, petrochemical and chemical plants have in common: Each consists of reactors, piping, tanks, towers, heaters, pumps and other components that must work together to produce profitable products.

Your new processing facilities do just that when you entrust the job to Procon. A world-wide organization specializing in process construction, Procon builds, within your budget, plants that not only meet full performance specifications, but often exceed them!

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To begin with, Magcobar technology itself is more than money can buy. It gives you an extra assurance of success. Magcobar technology allows you to take advantage of every cost cutting opportunity. It helps you to drill better, more profitable wells. But, more than that, Magcobar technology helps you plan right from the start. The Magcobar **planned mud program** keeps the over-all cost of drilling down. And Magcobar can base this planning on its broad experience, the quality of its products, and the skill of its mud engineers. It's all to your advantage! Wherever in the world you are drilling, begin now to plan with Magcobar for your next wells. You can be confident of cutting high drilling costs and of a well done with Magcobar technology.

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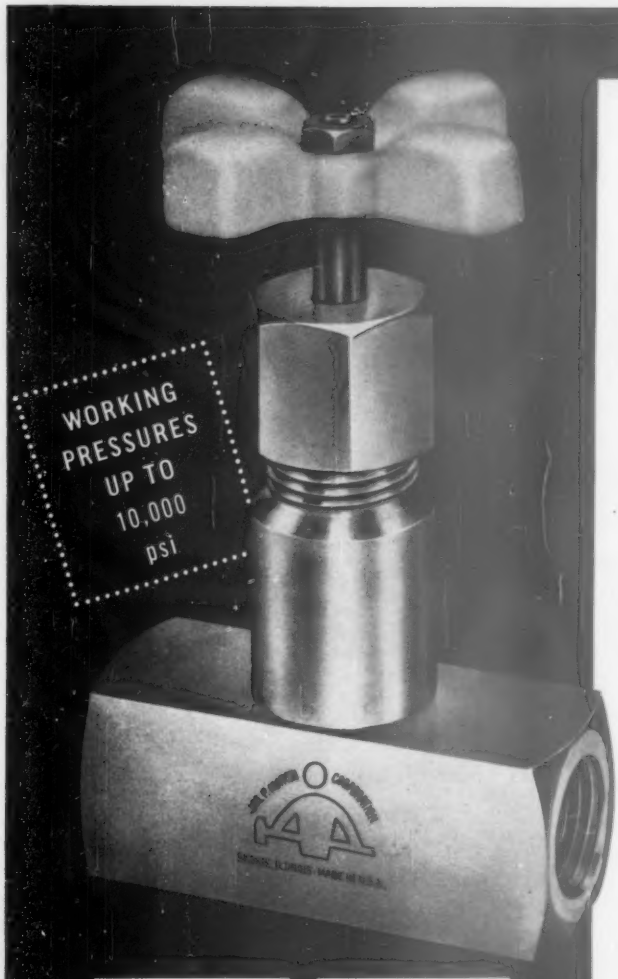

Know it by the yellow handle

Use it because it embodies features never before combined in a needle throttling valve . . .

It is the first throttling and shut off valve that serves the whole range of pressures—from low to 10,000 psi—with equal efficiency all the way through.

It is the valve in which body and stem guide are one piece—completely fused into an integral leak-proof unit by the exclusive Marsh "Conoweld" process.

It is the valve in which the stem is precision machined and ground. Perfect stem alignment and fine threads provide easy and precise throttling. Special "Marpak" packing always holds tight; never binds.

Bodies of the 1900 series identified by the yellow handle are machined from high grade carbon steel bar stock marked in accordance with M.S.S. regulations showing size, material and service. Stems are 416 stainless steel. Valves are available in the patterns shown below; sizes ⅛", ¼", ⅜", ½", ¾" and 1".

Marsh Needle Valves are also available in 416 stainless steel throughout (identified by green handles). *Write for bulletins.*

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Division of Colorado Oil and Gas Corporation
Marsh Instrument & Valve Co. (Canada) Ltd.,
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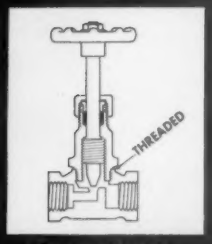
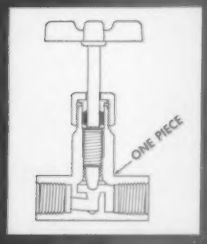
Sect. 15, Houston, Texas

In stock at your nearest Supply House



Conventional Construction



Marsh Construction

In conventional valve (left) stem-guide is threaded into body . . . can be backed out when valve is fully opened, causing real trouble when pressure is high. Can't happen with Marsh design (right). Marsh stem-guide is welded to body.

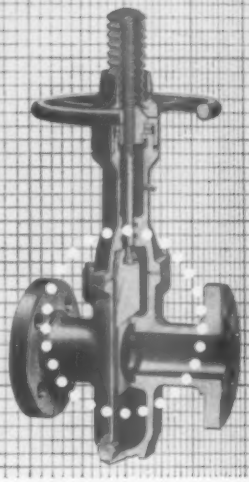
MARSH

SERIES 1900

Needle Valves

"Smooth sealing... upstream and down"

PRODUCT OF W-K-M's
Creative Engineering



FLOATING SEATS MAKE THE SEAL

Seats are specially formulated rubber molded to a hardened steel insert. They float against the gate. When the gate closes, line pressure forces the gate against the downstream seat making a tight seal. The upstream seat maintains its seal against the gate for an upstream seal. The valve provides a tight seal under little or even no line pressure or under vacuum conditions.

W-K-M's new Pressure Sealing Gate Valve

Almost without effort . . . you get a tight seal on *both* sides of the line. The secret? A unique seat design that puts line pressure to work *for* you. The greater the pressure, the tighter the seal!

Seats automatically adjust for wear . . . automatically relieve excessive body pressure. And in-the-line overhaul is easy.

Specify W-K-M's economical new Pressure Sealing Gate Valve for pressures to 720 psi (cwp) and temperatures to 250° F. Sizes 2" through 30". *At leading supply stores everywhere.*

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They Say—

No sliding royalty, please

Dear Sir:

In an article on page 88 of your June 6 issue ("California Studies Leasing Methods"), there was an erroneous interpretation of Humble's stand on the matter of California offshore leasing methods.

Your report indicated that Humble favors the award of offshore leases on a cash-bonus basis with a sliding royalty.

The fact is that Humble has always favored cash-bonus bidding with a fixed royalty, and this was the method advocated by our representative. Our representative did not say that "the state shouldn't gamble with its resources by adopting a fixed royalty rate on leases." Instead, he tried to show that a cash-bonus system, with a fixed royalty, offers the greatest incentive to exploration and also provides the most long-term benefits for the state.

It was not the fixed royalty with which we took issue. It was the so-called royalty bid, i.e., one with no cash bonus and with a sliding royalty.

Ed J. Hamner
Board of Management
Humble Oil & Refining Co.,
Humble Division
Houston

Articles had appeal

Dear Sir:

Your very comprehensive summation on the Appalachian districts (OGJ, May 30, p. 54) impresses me as I have done considerable work in some of the Appalachian areas. It especially appeals to the independents as test holes are relatively shallow and costs are not out of line.

Peter B. Bike's resume on Arizona (May 30, p. 131) also appeals to me as I recommended northeast Arizona over 40 years ago. While Apache County has the helium gas, natural gas, and oil, the Black Mesa basin has hardly been scratched. The holes have largely been on the periphery.

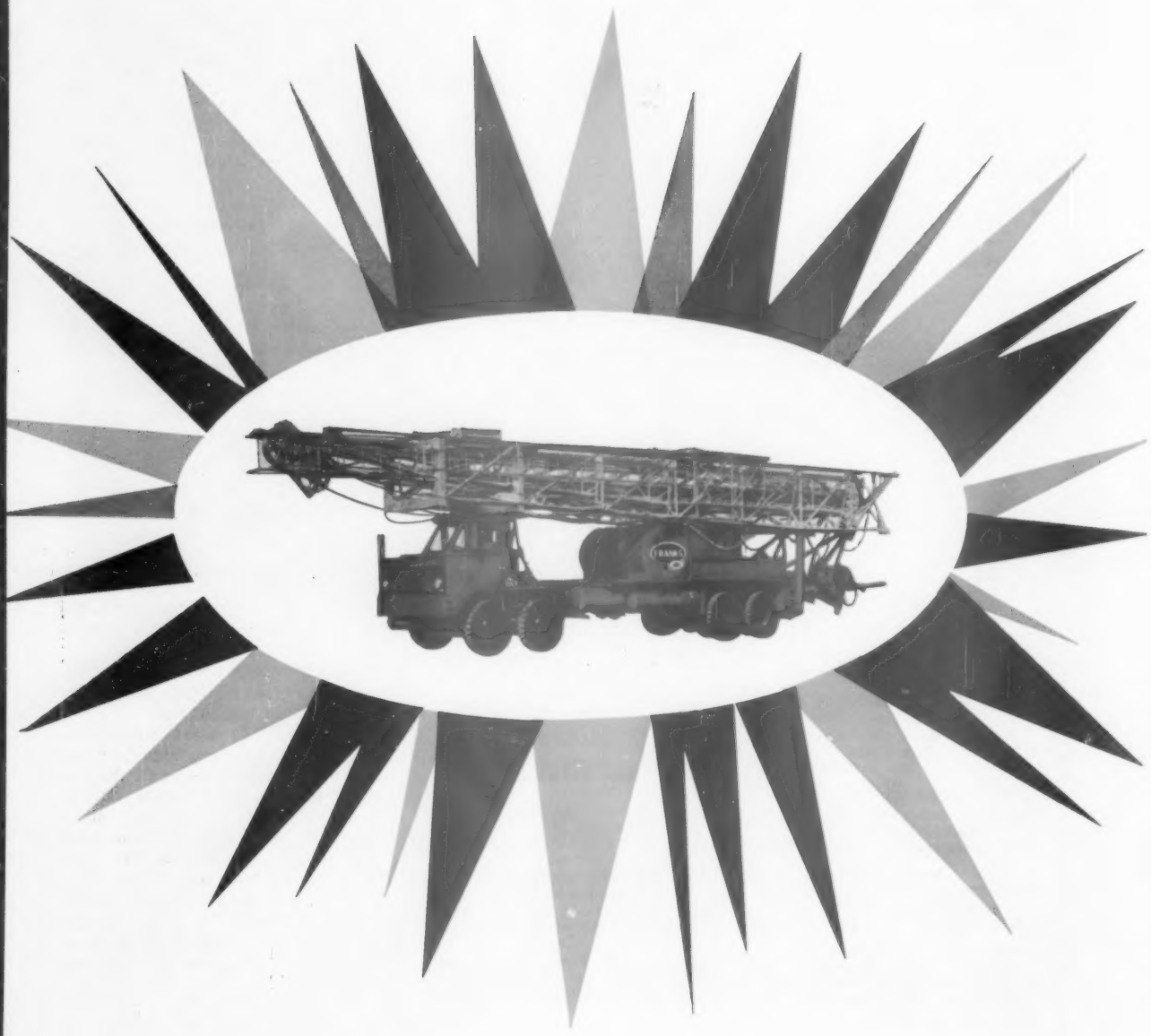
There are numerous untested structures and possibilities of stratigraphic traps in beds of lower Permian, Pennsylvanian, Mississippian, and Devonian systems.

Pressures will be low—below normal—but air drilling and careful fracturing should open some new gas and

FRANKS

EXPLORER

Rocket



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Now, this **difference** is what keeps the Franks Explorer ahead of the pack. It's the difference which makes superintendents prefer Franks units on their jobs. It's the difference you feel in your pocketbook when you trade it in. The higher resale value of Franks Explorers speaks louder of this difference than any words we can dream up.

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oil fields. The area certainly has not been adequately tested and well justifies additional test holes.

Dorsey Hager
Consulting Geologist
Salt Lake City

Cable-tool costs

Dear Sir:

In regard to cost estimates for cable-tool drilling in Pennsylvania (OGJ, May 30, p. 57), conversations with producing company officials would indicate that for an oil well of a depth between 1,700 and 1,800 ft. completed in the Bradford sand with all equipment, cost including fracture should be in the vicinity of $9,000.

Wells in Pennsylvania are not usually cased to the producing sand in the Bradford since it is only necessary to case past the water point, which may be up to 500 ft. maximum. Of course, you have to figure on tubing down to the producing formations, fittings, and pumping jack. The example cited above includes an estimate of $2,000 for fracture, making the well, fully equipped, $7,000.

Using your estimate of $1.65 per foot drilling cost, drilling 1,800 ft. would cost $2,970, leaving a balance of $4,000 or so for all equipment and other labor expense.

Of course, such contracts are on a footage basis and not on a turnkey basis, figures for which would tend to be higher depending on local drilling conditions.

I hope that the above figures will help to set forth more fully the cable-tool situation in Pennsylvania.

Edward W. Rosenbaum
Philadelphia.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

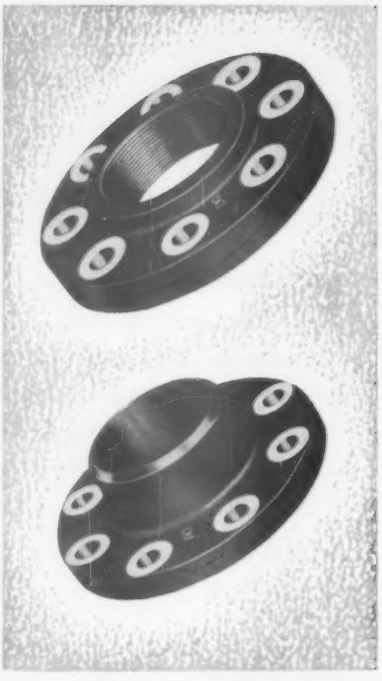
JULY

11-20 University of Michigan, engineering summer conference, applied mathematics for chemical and metallurgical engineers, Ann Arbor, Mich.

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur, Springs, W. Va.

29 Southern Gas Association, transmission section roundtable conference on use of electronic computers by engineering personnel, and employe relations section accident prevention



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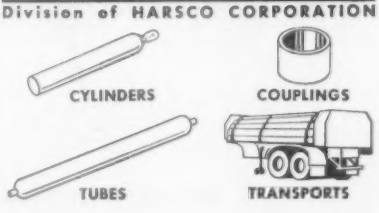

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Beautiful [BETZIE] *sets up in One, but One, hour!*

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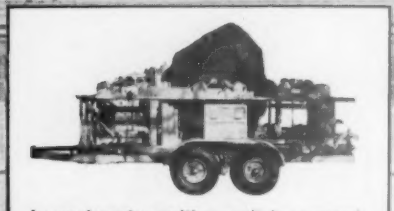
The phenomenal Polyken savings—as real as day—will make you gasp, yes, in astonishment.

★ ★

ONWARD! ☞ ☞ ☞ ☞ ☞

NOW! A portable high-speed taping machine for Polyken cleans, tapes and



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Probably the best thing about the Betzel taping machine and Polyken tape is the absence of all the nasty problems of hot dope. The highly mobile "Betzie," developed jointly by Polyken and A. E. Betzel, sets up in an hour (comes down in half the time).

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What's more, permanent Polyken tape can take almost anything—as already proved by its many hundreds of miles and years of hard work. It's being used in such tough terrain as the

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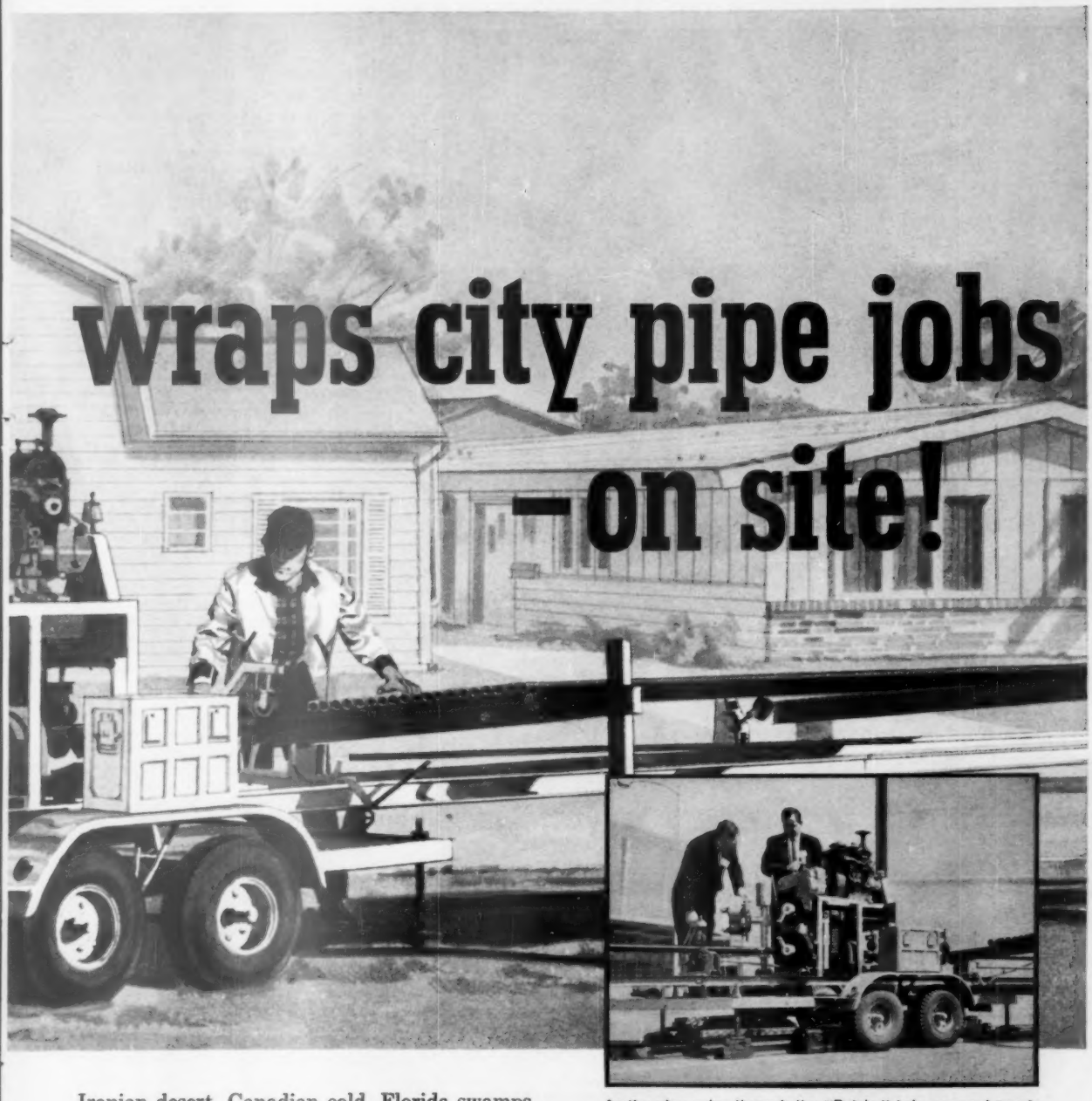

Iranian desert, Canadian cold, Florida swamps and southern California mountains.

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roundtable conference, Baker Hotel, Dallas.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-16 North Dakota Oil and Gas Association, annual meeting, Grand Pacific Hotel, Bismarck.

15-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

7-10 Billings Geological Society, annual field trip, Hebgen Lake-Madison Valley area of southwestern Montana.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

16-17 Kansas Geological Society, twenty-fifth annual field conference, northeastern Oklahoma, Western Hills Lodge, Wagoner, Okla.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, an-

TUBINGLESS COMPLETIONS NEED.....

CUSTOM BUILT CEMENTING TOOLS

TUBING SPACER INSTALLATION

As tubingless well completions and slim hole operations have become more and more popular, many problems have arisen in connection with the reduced diameters now required in small downhole casing equipment and accessories.

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. . . hard rubber, positive type rib wrap-around spacer, for centralizing single and multiple string tubing . . . tapered to help prevent coupling interference when running tubing . . . 5/8" minimum stand off provides less fluid restriction. Easily applied with banding.

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. . . incorporates a novel principle of hydraulics. Two sleeves are housed within the body of the tool. The lower or opening sleeve seals tool ports during circulation and passage of cement for lower stage of job. The upper or closing sleeve seals off the tool ports after completion of upper stage . . . Bomb Type Opening and Closing Plugs are used to operate the tool sleeves; Displacement Type Plugs may be furnished on special order.

"DV" MULTIPLE STAGE TUBING CEMENTER

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AND MANY OTHER TUBING ACCESSORIES

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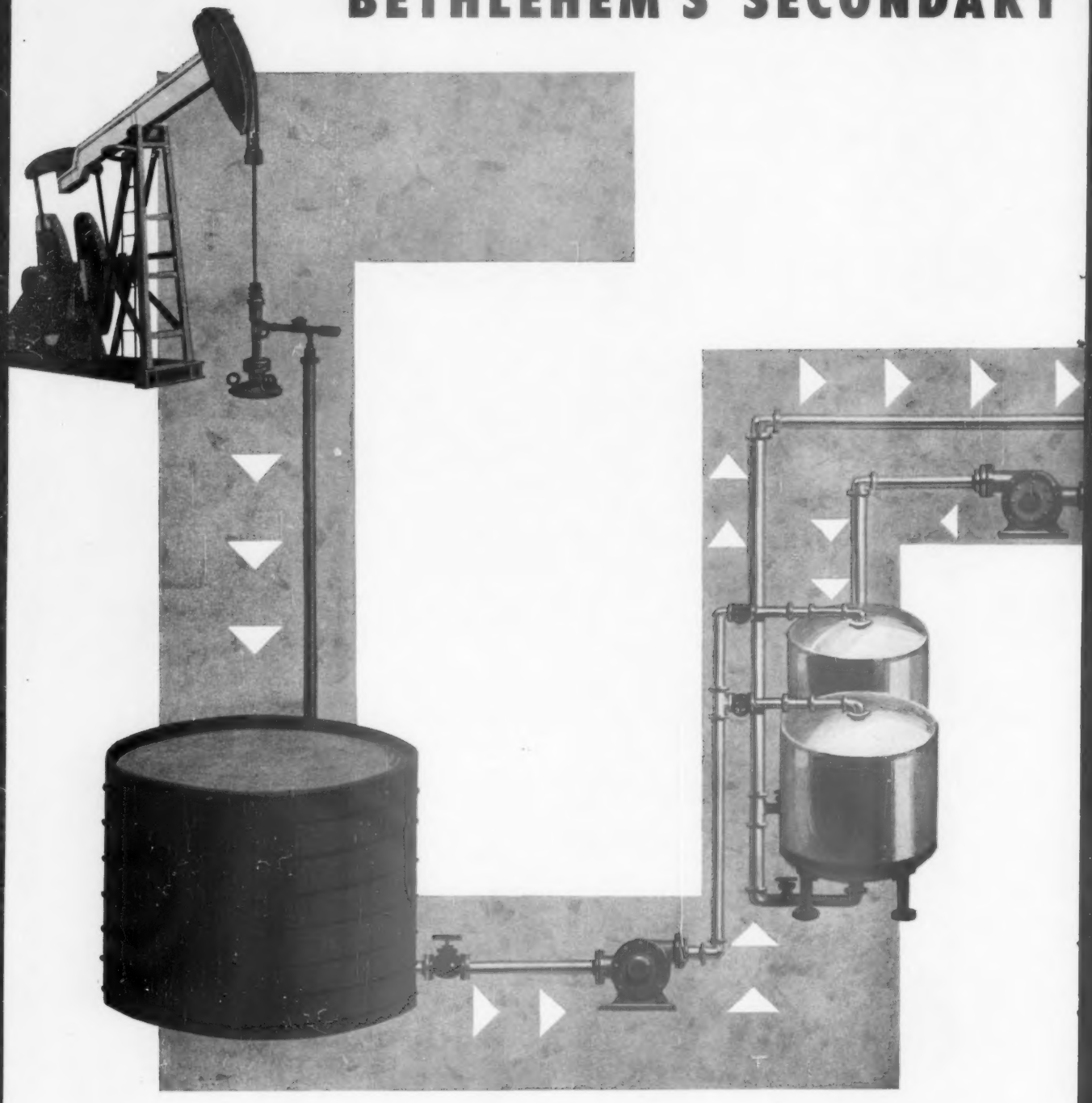

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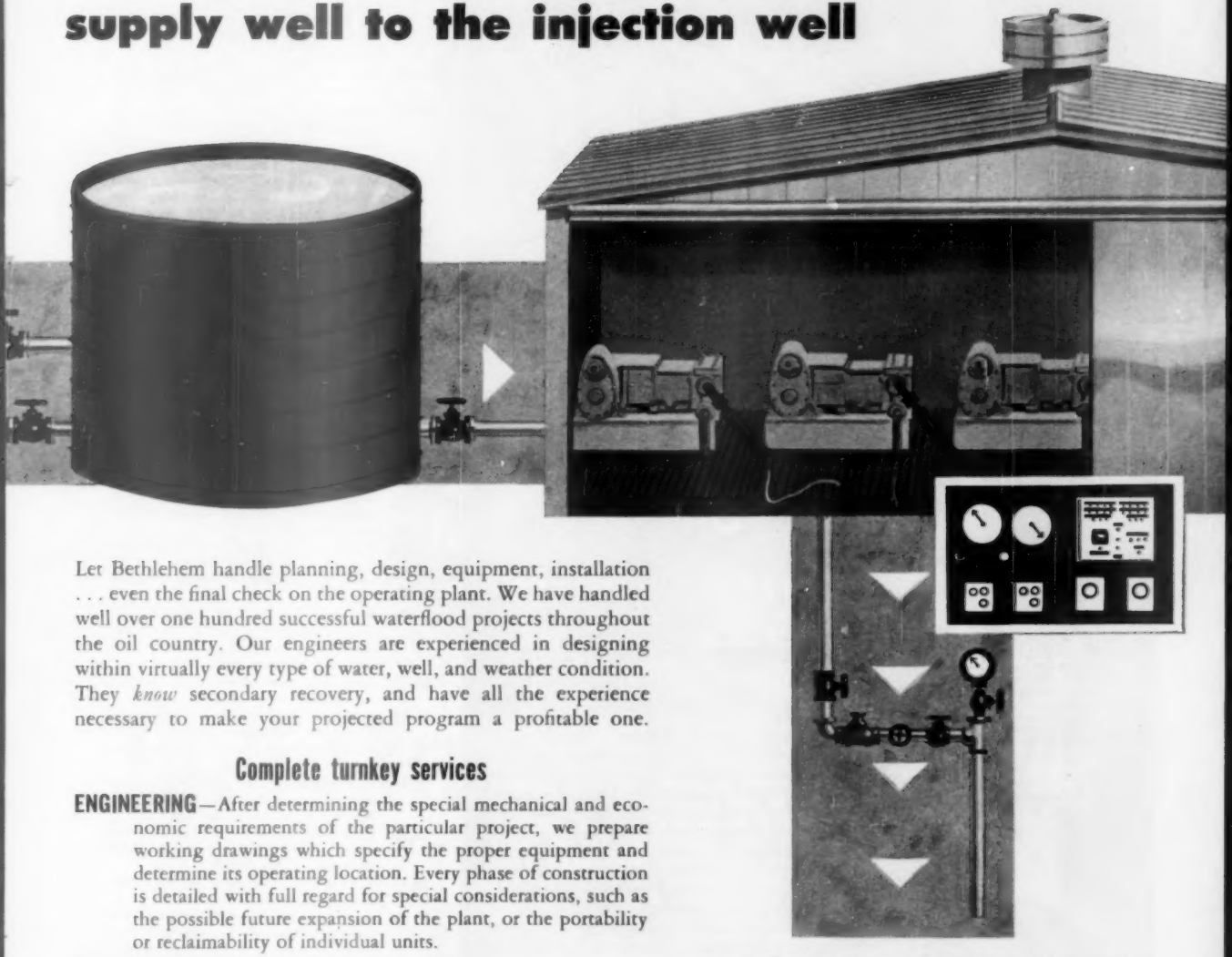

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nual meeting, Westward Ho Hotel, Phoenix.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

27-29 Mid-West Gas Association, annual school and conference, Memorial Union, Iowa State College, Ames.

29-30 Mid-Continent Oil and Gas Association, Mississippi - Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Odessa Oil Show, Odessa, Tex.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

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50 years ago

July 7, 1910

Hardly before its new pipeline from booming Caddo field, north of Shreveport, to its Baton Rouge terminal and refinery has been fully broken in, Standard Oil Co. of Louisiana is finding it necessary to lay another 8-in. line. Work will begin immediately on the additional 300-mile project.

The long-expected break in crude-oil prices began to show up in California the past week with oil being delivered at San Francisco Bay points at 90 cents a barrel, 10 cents under the $1 quotations in effect for many months. Reports of contract sales in the field as low as 45 cents a barrel also were heard during the week.

Following the unexpected quick collapse of Preston (Hamilton Switch) field, in Oklahoma, National Supply Co., Oil Well Supply Co., and Frick-Reid Supply Co., which early set up stores in the field in anticipation of big drilling plays, are moving into nearby Okmulgee.

25 years ago

July 4, 1935

Michigan oil producers in a specially called emergency mass meeting unanimously approved a plan for voluntary proration supplanting federal control until the Oil and Gas Association of Michigan can present its petition to the state legislature for state control of production. Rapidly rising oil output viewed with alarm.

The largest contract ever entered into by independent jobbing interests was closed last week by a North Carolina group recently organized under the name of Carolina Terminal, Inc. It calls for the delivery by James B. Berry Sons Co., marketing organization, of between 132,000,000 and 190,000,000 gallons of gasoline and kerosine over a period of 5 years.

10 years ago

July 6, 1950

Sinclair Refining Co. purchases refining and pipeline facilities of Wood River Oil & Refining Co. Newly acquired 30,000-bbl. refinery at Hartford, Ill., is seventh for Sinclair. It boosts Sinclair's domestic crude-processing capacity to 330,000 bbl. daily. Cracking capacity raised to 254,500 bbl.

Humble Oil & Refining Co. opens Alabama's second oil field, located at Carlton, in Clarke County. Its discovery well is completed on the pump making 80 to 100 bbl. of 18.2°-gravity oil per day from Tuscaloosa sand at 5,419-29 ft. Location is 35 miles southeast of state's first field at Gilbertown.

JOURNALLY SPEAKING

Independents' Independence

THIS ISSUE being dated July 4, which is Independence Day, gives us a tenuous excuse (through the medium of a very poor pun) to unload a few impertinent observations about oil independents.

There have been many attempts to define an independent oil producer, but none of them has been very satisfactory. Even the Independent Petroleum Association of America has had a great deal of difficulty categorizing its own membership. Maybe an independent is, by definition, unclassifiable.

From one point of view the name would seem to be completely inappropriate. In many respects the "independent" producer is the most non-independent person in the oil industry. He is completely dependent on others for his market—and the market is, after all, what he is in business for.

The independent has practically nothing to say about how much crude he will sell, what its price will be, who will buy it, what refineries it will go to, how it will get there, or what products it will be made into.

And in times of crisis, like the present, the independent seems completely dependent on the majors to protect his interests, bail him out of trouble, and keep the whole industry on an even keel. Oh, he has ideas—and is very vocal about expressing them—but they usually boil down to ideas about what somebody else should do.

Perhaps it is in the realm of ideology that the true definition of an independent may be found. To mix a metaphor, an independent might be defined as one whose mind wears no man's collar. He doesn't let anybody else do his thinking for him. He formulates his own ideas and conclusions independently. At times—particularly in the case of some dyed-in-the-wool inde-gol-durned-pendents—these conclusions seem to be quite independent of facts and logic.

To some it might appear that "independent" is synomymous with "inconsistent." That would be your conclusion, not ours. But here are some situations to ponder:

In Texas the independents are steadfast champions of proration. They say it permits them to exist, keeps them from being crowded out by the majors, gives them an equitable share of the market, and is the foundation of the state's oil industry.

In the Rocky Mountains the independents are steadfast opponents of proration. They say it would put them out of business, permit the majors to crowd them out, deny them a fair share of the market, and cripple their states' oil industry.

To Texas independents the word "unitization" is like a red flag in front of a bull. They say it would take away their rights, put them out of business, and let the big boys tromp all over them.

But in the Rockies, where the federal Government has required unit operations on public lands for a generation, the independents defend unitization as their salvation and the true way of life.

Texas independents carry a torch for the rule of capture. They say it is their inalienable right to capture all the oil they can reach, even though most of it is drained from a neighbor's land. But their rule of capture applies only subsurface, not after the oil is above ground. They don't believe in applying the rule of capture to markets. A man isn't allowed to supply his own market with his own oil; he must share it with other producers.

The other day we listened to an independent producer rail against refiners for letting the "incremental barrel" ruin the market. They should, he said, stabilize prices by cutting runs and reducing stocks of refined products.

We observed that this would either reduce the demand for crude or build up crude stocks tremendously, and suggested that the producers in his state could help the cause along by agreeing to some proration.

"Oh, no," he shot back. "That would increase our unit costs. It costs just as much to operate a lease at half of MER as at full capacity. We can't afford to curtail production. The trouble is all with those refiners for running so much."

What we like about independents is their complete independence of thinking.

—Henry D. Ralph.

The importance of Simplicity in a retrievable squeeze packer

Complexity is a retrievable squeeze packer's worst enemy. Simplicity of design is the best guarantee that the packer will do its job well and retrieve.

Simplicity and reliability go together in the Baker Full-Bore Cementer. This rugged tool is trimmed to fighting weight. It sets and packs off easily. It holds pressures from above or below, and does it with a tenacious grip. It retrieves easily.

Here's a tool so good it has changed everybody's ideas on how a squeeze packer should perform. Thousands of successful high pressure cementing, frac, and testing operations demonstrate its success.

THE BAKER SERVICEMEN who run the Full-Bore Cementer have two important things working with them and for you. They have professional skill in running Baker service tools, and in the Full-Bore they have a superior tool to run. The combination offers a dependability that's hard to equal.

BAKER FULL-BORE CEMENTER

Product 410-C

BAKER OIL TOOLS, INC. HOUSTON / LOS ANGELES / NEW YORK

Facts about a reliable squeeze tool

1 It is an important squeeze cementing tool. (Full Bore makes reversing out sand bridges easy; and allows re-perforation, when necessary, without a round trip with tubing.)

2 Ability to hold pressure from above or below makes it ideal for testing casing.

3 Optional Baker Model N Full-Bore Tubing Tester permits testing of tubing string in conjunction with operation of the Cementer.

4 The Cementer is an important tool for formation fracturing and high pressure acidizing. (Full Bore helps prevent sand screen-out when fracturing. On completion of frac or acidizing operation, tubing may be swabbed immediately, without having to reset the Cementer. When pressure reverses, opposite set of slips takes over automatically. Packing elements stay packed off, resist pressure from either direction.)

5 It is teamed with the Baker Retrievable Bridge Plug in straddle operations—either single-zone or selective multiple-zone. Together they can straddle a virtually unlimited interval. And: because both Cementer and Plug are so easy to pick up and relocate, any number of zones can be tested and treated in one round trip.

6 An unloader allows circulation above the Cementer, or equalization of tubing-annulus pressures, when desired.

7 The packer retrieves simply and easily. For added protection, two emergency release mechanisms are built-in.

Kansas gives an economics lesson

SOME LESSONS in elementary economics may be drawn from the behavior of crude-oil prices in the past couple of weeks.

In Kansas a price cut was restored in the wake of an increase in refined-products prices and following a complete shutdown in two counties and tightened proration throughout the area.

In Illinois and Michigan crude prices fell in spite of improved products prices but with a continuing oversupply of crude in the area.

MANY FACTORS CONTRIBUTED to these two events. But two fundamental facts stand out:

- The price of crude cannot be unrelated to the price of products.
- The products market is influenced by the volume of crude available.

For many months there has been an oversupply of oil, products prices have been abnormally low, and crude prices have been softening. There is a definite relationship among these three conditions, though it is often obscured by a welter of subsidiary issues and effects.

The Mid-Continent products market this spring was probably the weakest in the country. There were many causes, but not the least was the refiners' urge to process the unneeded quantity of crude offered them.

Fortunately, some of the states supplying this market had the machinery to curtail production and the good sense to use it. The recent improvement in Mid-Continent products prices is in no small measure attributable to the current tight proration in Kansas, Oklahoma, and Texas.

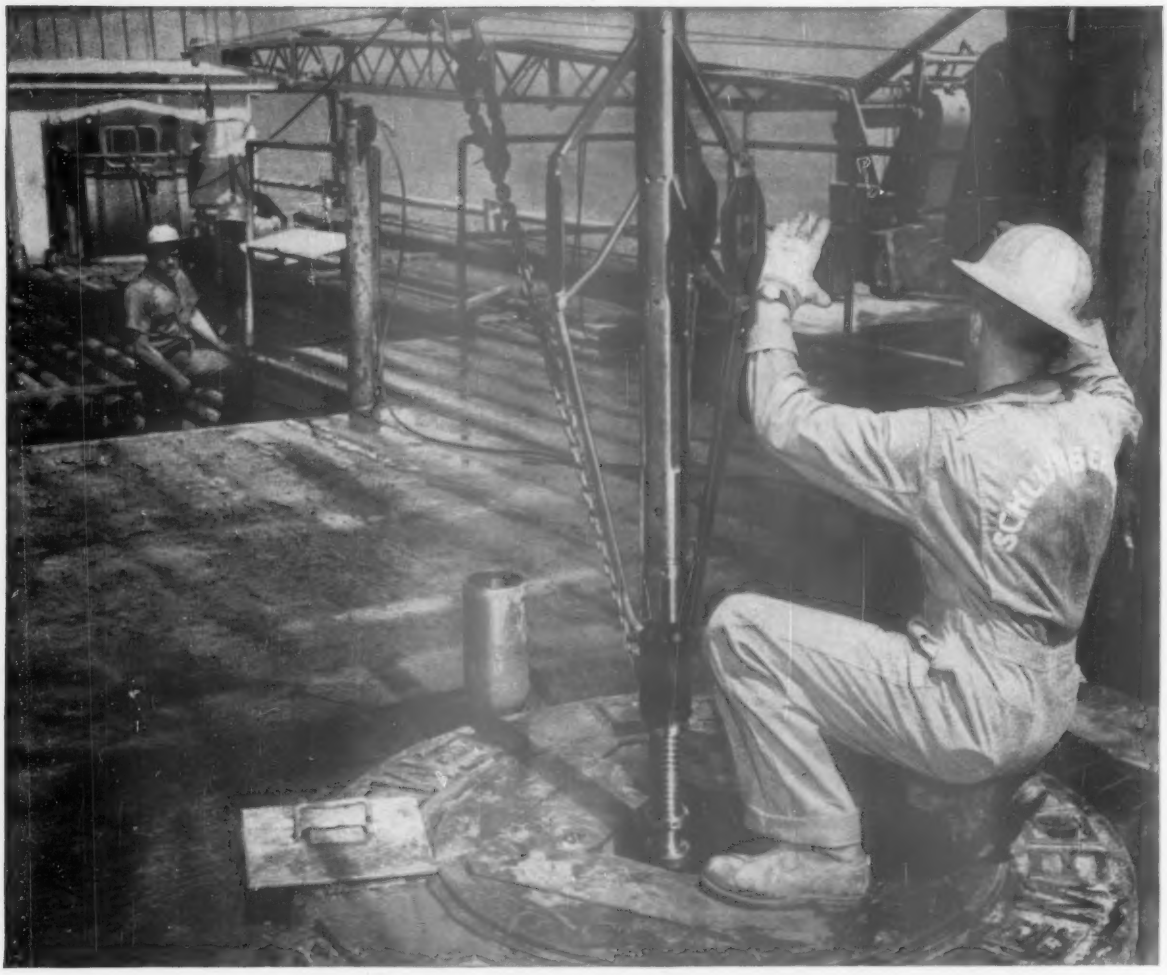
In Illinois and Michigan, products prices also went up. But refiners there took advantage of the prospect of continuing oversupply of crude in the area and lowered crude prices. It remains to be seen whether the improved refinery margin will result in bringing products prices down again or crude prices up again. The latter is unlikely so long as ample supplies of crude are available at the lower price.

That's how the cycle works: Excess crude supplies invite excessive runs, undermine products markets, and weaken crude prices; balanced crude supplies reduce causes of market weakness and support crude prices.

KANSAS PRODUCERS can claim much credit for the restoration of their crude price. They asked that entire fields be shut in rather than sell at a loss. Their position was strengthened by like-minded producers to the south who understand the folly of unrestrained output.

Perhaps, in time, producers to the northwest and northeast—and the entire industry—will come to understand these basic economics:

The state of the products market determines the health of the industry; low products prices will bring down crude prices; low products prices result from refinery runs in excess of demand; excess crude supplies foster excessive runs; failure of production to move downward with demand undermines the products market.



Logging a well with the Schlumberger Continuous Dipmeter. Non-magnetic "K" Monel alloy housing protects its reference compass as it registers subsurface formation slopes and changes.

How non-magnetic "K" Monel helps map mountains underground

One of the important "mapping" tools used to chart subsurface peaks and valleys and reduce dry holes is the Schlumberger Continuous Dipmeter. It measures and records dips and faults in formations, as well as the inclination of the hole, relying on a precision compass for a directional standard.

"K" Monel* age-hardenable nickel-copper alloy plays a key part in this dipmeter's operation . . . a housing of this non-magnetic alloy protects the delicate compass from shock and corrosion without affecting the compass reading.

Schlumberger engineers are well aware of the special properties of "K" Monel alloy. They've specified it for years in their Photoclinometer compass housing. Specified it, too, at many other critical points in Schlumberger instruments where corrosion, heat, pressure, shock, magnetism, or a combination, rule out common materials.

Your own producing costs may well be lowered by "K" Monel alloy in parts subject to corrosion, stress, or magnetic conditions. Get more information...send today for "Metals to Make Petroleum Production Equipment Produce More." For help in well logging problems, contact Schlumberger Well Surveying Corporation, Houston, Texas.

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

*Inco trademark

"K" MONEL®

Gas Service Lasts for Life, Court Rules

• Once a producer begins service to a pipeline, he cannot terminate it, or file new rates, even though the contract has expired. This ruling by the Supreme Court thus further reduces the bargaining power of the producer.

THE U. S. Supreme Court handed out more bad news for independent producers of natural gas last week.

The high tribunal ruled that once a gas producer starts selling gas to an interstate pipeline company, he must keep selling permanently.

The high court ruled 5-4 in two parallel cases.

In each case, gas producers had asked the Federal Power Commission for certificates for limited periods. The FPC gave the certificates without time limit. Each producer accepted the certificate, but challenged the ruling in the courts.

Justice Brennan wrote the opinions for the majority in the two cases, which involved:

. . . **Sunray Mid-Continent Oil Co.,** which was selling gas from Vermilion and Lafayette Parishes, Louisiana, to United Gas Pipeline Co., under a 20-year contract calling for a price of 20.5 cents per M.c.f. and increasing by 1 cent per M.c.f. each 5 years. Sunray asked a certificate from the FPC for the life of the contract, but received one without limitation.

. . . **Sun Oil Co.,** which signed a 10-year contract for sale of gas from Gwinville gas field in Jefferson Davis and Simpson counties, Mississippi, at a price of about 8 cents per M.c.f. The contract expired in 1957, and Sun and Southern signed another for 20 cents for 20 years. Sun claimed the FPC's certificate for the 8-cent gas expired with the life of the contract, and filed the 20-cent level as an initial rate; the FPC objected, and called it a change of rate.

Justice Brennan said Sunray's reasons are "obvious" and if it gets what it wants the effects would be "damaging."

Majority view . . . For instance, Justice Brennan said, if Sunray were to prevail, "the way would be clear for every independent producer of natural gas to seek certification only for the limited period of its initial contract with the transmission company and thus automatically be free at a future date, untrammeled by commission regulation, to reassess whether it desired to continue serving the interstate market."

Further, he said, gas producers might write contracts that provide for "termination in the event of a rate reduction by the commission."

Third, he said, "pipeline companies—whose dealings with local distributing companies generally also take the form of a 'sale' of gas to them—could insist on a similar provision."

Fourth, "if the pipeline company were left free to cease its service to the local distribution company, a local economy which had grown dependent on natural gas as a fuel would be at its mercy."

Fifth, if the certificate were for only 20 years, or any other period, further service would "require a new certificate." In such cases, the producers could file an initial rate, which is not subject to suspension, but only to a Section 5 proceeding of the FPC, which would have to prove the rates are too high to haul them down.

Sixth, if the sale is regarded as a permanent one, any upward movement of the gas prices would be subject of Section 4 of the act, and could be suspended by the commission, and the company would have to prove the new rates are just and reasonable.

Justice Brennan said that the use of Section 5 rather than Section 4, along with the producer's power to abandon service, would give the producer a "substantial" power.

After discussing these "practical consequences," he went into the law on the matter, and made a distinction between the Natural Gas Act's use of the term "service" rather than "sale." While a sale could be limited at the will of the producer, he said, a service is different.

The FPC "has from an early date taken the view that there is a continuing obligation to perform 'service' imposed by the act, which outlasts the term of a seller's original contract of sale," Brennan said.

Summing up, Justice Brennan said that in certificates "the commission controls the basis on which gas may be initially dedicated to interstate use. Moreover, once so dedicated there can be no withdrawal of that supply from continued interstate movement without commission approval.

"The gas operator, although to this extent a captive subject to the jurisdiction of the commission, is not without remedy to protect himself." That remedy, the Justice said, lies in Section 4d which provides a way of raising rates, subject to commission approval.

The Sun case . . . Justice Brennan also wrote a brief opinion in the Sun case. The justice relied heavily upon his reasoning in the Sunray case, and wound up saying:

"It would surpass belief to say that under these circumstances the commission tendered and the applicants received these certificates under the assumption that they were limited in time to the terms of the contracts on which the applications were based."

The Courts of Appeals had backed up the FPC in each case, and now the highest court has done the same.

The dissenting view . . . Justices

Frankfurter, Whittaker, Stewart and Harlan dissented—and dissented vigorously—with the majority's ruling. Harlan wrote the dissent, covering both cases.

Justice Harlan said that the court has "strained the provisions" of the gas act "beyond permissible limits in order to reach a result which it deems more appropriate to effective regulation." He also said:

"I fear this is another instance where the court has taken impermissible liberties with statutory language in order to remedy what it considers an undesirable deficiency in the way Congress has written the statute."

The majority, he said, fails "to take into account the basic distinction between an interstate pipeline and an independent producer of natural gas," adding:

"The court's basic error, it seems to me, is its notion that the petitioners are rendering a continuing service to the public in the same sense as a pipeline or other conventional utility, to which the usual modes of utility regulation are equally applicable."

The minority pointed to the high court's ruling in the Phillips Petroleum Co. case in 1954 and explained:

"It is thus evident that the court recognized that, as to independent producers, the act envisaged only a limited scheme of regulation, namely control over the prices and the other terms of sale of their natural gas."

Producer's rights . . . The minority went on:

"Since he need not dedicate his gas supply to the interstate market at all, surely he may propose the amount he will dedicate. The commission, of course, need not accept the proposal. But neither can it in effect require acceptance of a certificate authorizing something more, on pain of denying applicant any certificate, without satisfying the requirements of Section 7e for the imposition of conditions on certificates."

The minority "cannot understand" how the majority reads into the act that sales are the equal of service. There is "nothing in the statute" which makes them the same.

Justice Harlan touched on the "intolerable consequences" foreseen by the majority if Sun is upheld, by possible stopping of sales and "a higher price." He pointed out that the commission has no duty to assure continuous service by independent producers. And, he said that contracts for a short term, if they are as bad as the majority seems to think, "would not be in the public interest" and thus would be denied by the commission.

Imaginary evils . . . Under its powers, Justice Harlan went on, the commission can issue a certificate with "reasonable terms and conditions" but it would have to show they are necessary. For these reasons "the evils which the court imagines do not exist," he wrote.

He added:

"I would hold that where, as in (the Sunray case) an independent producer applies for authority simply to engage in a sale transaction specifically limited in duration, the commission has no authority to tender an unlimited certificate without bearing the burden of showing that such a departure from the proposal is required by the public convenience and necessity."

In a 1-page concurring dissent, Justice Frankfurter said:

"Concededly the commission has power to grant a time-limited certificate, and its denial of such a certificate is not free from judicial review. Therefore, it must give a reason for denying a proper application . . . Nor can the commission rest on the general spirit or the ultimate purposes of the Natural Gas Act, for to do so amounts to saying that the act forbids time certificates when in fact it does not."

Meet the New Import Boss

THE SWITCH to Lawrence J. O'Connor, Jr. as administrator of the oil import program isn't likely to cause any major change in the basic operation of the control plan.

For a while, at least, O'Connor is likely to follow the course of his predecessor, Capt. Matthew V. Carson.

Although O'Connor has been Carson's assistant in the Office of Oil and Gas, he has not been directly involved with Carson's other role as import administrator. Therefore, he is not thoroughly familiar with its problems and how it operates.

As a result, O'Connor does not have any changes in mind at this time, other than to try to carry on the program as Carson has done.

Furthermore, O'Connor is a quiet, deliberate man who would not be likely to attempt any major changes merely to show that a new man is at the wheel.

His appointment to succeed Carson, who will continue to be director of the Office of Oil and Gas, will probably meet with the approval of producers because O'Connor is familiar with their segment of the industry. He has been director and vice president of the Houston chapter of the Independent Petroleum Association of America and was chairman of its tax-study committee.

He has gained working knowledge of various other problams of the industry during his term as assistant director of OOG, a job he has held since October 15.

His work as Carson's assistant caught the attention of Interior officials, and he became the choice to succeed Carson when the latter asked to be relieved of the assignment as import administrator.

L. J. O'Connor . . . Carson's successor as oil imports administrator.

O'Connor, 45 years old, was born in Tulsa. He went to school there and in Pennsylvania and attended college at Rice Institute and Harvard.

From 1938 to 1945 he was with Haskins & Sells, an accounting firm in Houston. He then joined the Goldston Oil Corp., Houston, and became its vice president and treasurer.

He resigned from that organization in 1958 to be a consultant on oil and gas exploration. Then, in 1959, he accepted the government assignment with Interior Department.

Needed: 100 Billion Barrels of New Oil In the Next 20 Years

Minor S. Jameson, Jr., executive vice president of the Independent Petroleum Association of America, sees a need to find and develop 100 billion barrels of oil in the U. S. in the next 20 years.

This is based on an estimated growth of 3% a year in demand for oil, and a faster rate of growth for natural gas.

To meet a demand of this size, he said, 100 billion barrels of new petroleum liquids would have to be made available from U. S. sources in the next two decades assuming U. S. output keeps pace with the demand and the present ratio of production to proved reserves is maintained.

Jameson was one member of a panel at an energy institute sponsored by American University in Washington, D. C., last week. Also on the panel were William R. Connole, former member of the Federal Power Commission, and Tom Picket, vice president of the National Coal Association.

Connole said that rising price, not the supply of natural gas, is the problem ahead. Gas, he said, may price itself out of many markets.

Pickett said that coal has a real future, as machines keep down costs; he said its future would be brighter if gas would curb its industrial sales, and if residual fuel oil sales were reduced.

Court Rules on Lease Issue

DEVELOPMENT of shallow pay zones is sufficient to retain the lease rights on deeper reservoirs, according to an opinion handed down in the United States district court in Wichita.

Judge Delmas C. Hill ruled that Westhoma Oil Co., of Denver, retained all its rights on acreage disputed by 27 plaintiffs who asked cancellation of leases as to mineral rights below the sea level zones of the Hugoton field reservoir.

The decision concerned hundreds of thousands of acres of leases in Southwest Kansas and elsewhere.

Plaintiffs argued that the leases expired by their own terms when deep production was not developed.

Plains Natural Gas Co., a Westhoma affiliate, obtained the shallow pay and unitized the leases into blocks. Westhoma was assigned the subsea rights.

watching WASHINGTON

Clyde La Motte

• Seven suggested ways to influence your congressman . . .

A VETERAN congressman, who shall remain nameless here, was asked the other day to list the most effective approach a citizen might use to get the best results from public officials in Washington.

The steps he suggested were, for the most part, quite elementary. Yet, the congressman said, it is surprising how often people fail to make use of them.

"Frequently," he said, "people don't let you know their views on an issue, so a congressman has to act in the dark. Sometimes he doesn't find out that someone is sore at him—or why—until he's up for reelection." This congressman, facing an election soon himself, shuddered at the mere thought of any unhappy voters in his district.

Pressed for some specific guidelines on methods a person should use in influencing—legitimately—his congressman, he came up with these seven possibilities:

Write him a letter. Sounds simple, and is. But when was the last time YOU wrote your congressman? Don't underrate the value of this approach. Congressmen pay extremely close attention to their mail for they consider it as the most accurate barometer of the attitude of the voters back home.

Go to see him. This may be the most effective of all, for it gives the two of you an opportunity to exchange views and to create a better understanding. Too, the congressman knows that if you take the time and trouble to make a trip to Washington to see him, you feel strongly about the issues you have in mind. So he will listen, particularly if you are able to present him with facts and figures to support your arguments.

If you don't make the jaunt to Washington, you should at least take advantage of the opportunity to talk with him when he returns to his district. If he's up for reelection, he will be especially receptive.

Let him know when you think he is right, as well as letting him know when you think he is wrong. Virtually all congressmen are human beings, meaning that they appreciate a word of praise. Since most people don't contact their congressman except to complain about something, it is refreshing to him to get a word of commendation. He'll remember it.

Support him politically, if possible. He will welcome campaign contributions, of course, but in many cases he would like your public support even more. This need not be limited to election years, but could be in the form of a public word of favorable comment on some vote or other action he takes while Congress is in session.

Oppose him publicly, if you have to. Frankly, some congressmen respond more quickly to this approach than to any other, because they want to quiet any voice of criticism.

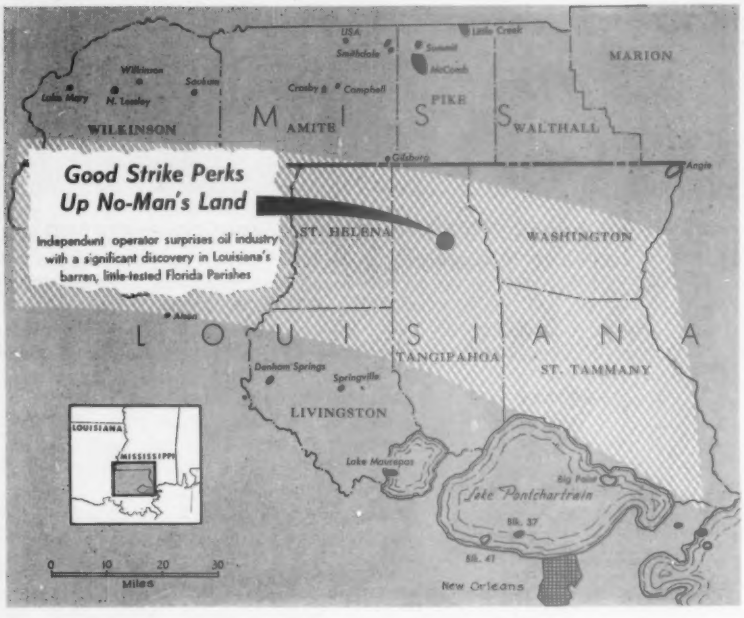
Work through groups on specific issues. This could be your oil association, your local Chamber of Commerce, or some other organization. However, to be most effective, any "chain letter" approach or march on Washington should be used sparingly.

Base your support, or opposition, on the congressman's over-all record. And let him know that is what you are doing. If you tell him that you'll never vote for him again if he votes "wrong" on one particular issue, you may only get his dander up.

A congressman recently voiced this peeve:

"For years I have supported oil legislation. Yet last year I got a hot call from an oil industry leader who raked me over the coals and said he'd never support me again. The reason? The way I voted on the Landrum-Griffin bill. He forgot all my other votes.

"I don't think that's fair or reasonable. And I just hope that man calls me again—even in an election year—to ask me for something. I'll give him an earful."



"Dry" Area Proven Productive

. . . as a rank wildcat in southeastern Louisiana flows 27 bbl. an hour. It opens a region long shunned by drillers.

A RANK-WILDCAT oil discovery has been made in southeastern Louisiana's long-neglected and little-explored region known as the "Florida parishes."

The discovery, Independent Operator Floyd Williams' 1 Lake Superior Piling Co., is 6 miles northeast of Amite, in Louisiana's Tangipahoa Parish.

It extends South Mississippi's prolific Lower Tuscaloosa sand production well across the border into Louisiana.

The well flowed at the rate of 27 bbl. of 36° to 38°-gravity oil per hour while testing through 12/64-in. choke. Flow was with gas-oil ratio of 500 cu. ft. per barrel, and pressure of 950 psi. Its pay, perforated at 12,176-195 ft., is in the upper half of a 37-ft. sand showing oil saturation. Total depth is 12,406 ft.

It is the first oil or gas production in Tangipahoa Parish. Except for a few gas-condensate wells in the Angie extension of South Mississippi's Sandy Hook field, 40 miles distant in the far-northeast corner of the region, it is the only production so far in all South Louisiana from formations older than of Tertiary age.

The area . . . Eight parishes comprise the more or less isolated group lying east and north of the Mississippi River and Lake Ponchartrain, and bordered on the north and east by the State of Mississippi. The region is between the Mississippi salt basin, on the north, and the Gulf Coast salt basin, on the south (see page 149).

Only production in this region has been from a few localized coastal-type Tertiary fields along the southern fringe, and the few gas-condensate wells in the Angie area at the far-northeast corner of the region, in Washington Parish. In addition to Tangipahoa, there are three parishes, West and East Feliciana and St. Helena, in which there has been no production.

The new discovery well is 12 miles south of the Mississippi line. It is 15 miles southeast of the nearest production, a lone Tuscaloosa well (Gillsburg field) just inside the Mississippi line, in the southeast corner of Amite County.

This well, completed early in 1952, in turn is more than 15 miles south of the nearest production in the revived active Tuscaloosa play that has been spreading south and southwestward through Mississippi's border counties of Pike, Walthall, and Amite, and that has accounted for such sizable fields as Little Creek and McComb.

Peace in Kansas:

• State lifts shutdown, and producers drop legal moves; conditions back to "normal."

THE RHUBARB over Kansas crude has evaporated and the state has returned to the status quo ante.

Derby Refining Co. canceled the 20-cent price cut it had posted in Sedgwick and Sumner counties May 16 and restored the old gravity scale with $3.05 top as of June 28.

The Kansas Corporation Commission revoked its order which since June 1 had shut in more than 544 wells in 39 fields in those counties where Derby was the sole purchaser. About 8,000 bbl. was involved.

Independent producers dropped their legal maneuvers to have Derby's gathering system in the area declared a common carrier so they could use it to move their crude to other purchasers. They also withdrew a complaint about rates of Jayhawk Pipeline Corp., half owned by Derby, which gathers crude in other parts of Kansas.

Derby attributed its about-face to an improvement in the products market. It said that price wars in its marketing area had diminished so that it was raising its wholesale price of gasoline by one-half cent per gallon and thus could afford to pay more for crude.

When the crude cut was announced

PIPELINE

Some 33 miles of big-inch gas line will be laid by Mountain Fuel Supply Co. this summer and fall. The company plans 6.7 miles of 24-in. from Mountain Dell to Sunnyside station, 6.4 miles of 20-in. from Kanda Junction to Green River station, and 20 miles of 20-in. from Piedmont to Yellow Creek, all on its Utah system.

Two projects under contract to Western Pipe Line Inc., were started last week. Western is laying 53 miles of 20-in. for El Paso Natural Gas Co. near Fort Stockton, Tex., and 17 miles of 10-in. for Texas Gas Transmission Corp. in Lafourche Parish, Louisiana.

Construction contracts for Mustang Fuel Corp.'s 8 and 12-in. gas line in Central Oklahoma have been awarded to Sadler Brothers Pipeline Construction Co., and Montin-Harbert Pipe Line Construction Co., both of Okla-

Derby Ends Crude Price Cut

in May, Derby's president, H. D. "Ike" Moore, blamed it on the demoralized state of the products market. He said that during the first quarter of 1960 Derby received an average price of $3.83 per barrel for refined products, a drop of 50 cents in a year. He said the company could not continue to operate at a loss and that crude prices could not remain stationary when product prices declined.

Last week Moore said that since May there has been an improvement in the Mid-Continent market, with higher demand and fewer price wars, thus permitting Derby to increase both its gasoline selling and its crude-oil purchase prices.

Allowables dip . . . Meanwhile the crude surplus in the Mid-Continent was eased somewhat by lower allowables in several states.

Kansas, itself, was prorated about as low during June as its law allows. All prorated fields had a top allowable of 25 bbl. per day—even deep ones with 80-acre spacing—and unprorated wells had a top of 15 bbl. on a lease-average basis.

The conservation director of the Kansas Corporation Commission, Jewel M. Ogden, recommended that the same schedule be continued through July. This provides a daily production of about 293,000 bbl. in the state.

Coincidentally, Oklahoma's Corporation Commission slashed its July allowable some 20,000 bbl. below the June rate of 507,000 bbl. per day. It set the basic rate at 12 bbl. per well, compared with 15 in June.

This is the lowest allowable Oklahoma has had in 6 years. It was counted on to eliminate the purchaser proration

The commission denied a request of Kerr-McGee Oil Industries, Inc., to continue prorating during July and is still considering a similar request by Rock Island Refining Co.

Sun Bails Out McComb Field

. . . by agreeing to take 5,000 bbl. daily at posted price for East Coast processing. New worry: Falling pressure.

SUN OIL CO. has come to the rescue of Mississippi's big, new McComb field by arranging to purchase 5,000 bbl. daily of its crude.

The action forestalls a field shutdown and, at the same time, preserves the $3.25 posted price.

Sun is a major producer in the field and will move the crude by tanker to its Marcus Hook, Pa., refinery.

The crisis at McComb arose when Esso Division of Humble Oil & Refining Co. announced it would quit taking its usual 5,000 bbl. daily (OGJ, June 20, p. 75).

McComb field is less than 1 year old, and crude is still trucked out.

Sun said it will continue to use Miller Oil Purchasing Co., Jackson, Miss., to truck the crude to Interstate Pipe Line's Liberty station for transporting to Baton Rouge.

Until Sun stepped in, operators in McComb field faced a shutdown on July 1 or the prospect of selling at 50 cents under the posted price.

While spared this fate, the operators still faced another major problem last week—drastically dropping field pressures. The field has been losing some 60 psi. per month.

An operators committee has been formed to take the lead in unitizing the field and starting a repressuring project. More than 100 persons hold operating interests in the field, and some 50 own 75%. The leaders hope to complete unitization by years end.

McComb field developed swiftly early this year (OGJ, Feb. 29, p. 44) and today has more than 100 wells. The per well allowable has been cut back by the Mississippi Oil & Gas Board from 300 bbl. daily to 65 bbl.

BRIEFS . . .

homa City. Cenex Pipeline Co.'s 8-in. products line in Montana and North Dakota will be built by D. Michael Curran & Co., Great Falls, Mont., and C. E. Wilson Construction Co. of Kansas City. Pipe Line Technologists, Inc., Houston, is in charge of engineering for the two projects. Both are scheduled for completion this fall.

A products terminal is being built on Great Lakes Pipe Line near Bethany, Mo., by three shippers on the products line. A four-tank, two-spot rack terminal is being constructed by Continental Oil Co., Skelly Oil Co., and D-X Sunray Oil Co. The pipeline is building a metering station to meter product to the terminal.

Some 23 miles of 10-in. crude line will be rerouted by Gulf Refining Co. near Carlyle, Ill., because of government construction of a reservoir in the area. The job will be finished by December.

Texas Eastern Transmission Corp. will spend $17.5 million this year to add 66 miles of 30-in. loops and 33,170 compressor horsepower to its mainline system. The plans, subject to FPC approval, will boost capacity by 50 million cubic feet daily to 2.24 billion. Most of the looping will be in Louisiana and Mississippi, with some in Ohio, Pennsylvania and New Jersey. Horsepower will be added to stations at Vidor, Tex.; Barton, Ala.; Tompkinsville, Ky.; and Opelousas, La. Texas Eastern hopes to complete the work in time for the coming heating season.

Also for Pipeliners . . .

IN THE NEWS: Supreme Court rules that once gas is committed to an interstate line it can't be withdrawn (p. 57) . . . Jump in crude price suspends question of common-carrier status of Derby crude line (p. 61) . . . Second gas-beneficiary tax in Texas is ruled unconstitutional (p. 68) . . . Bids being sought on two of this year's biggest foreign pipeline projects (p. 83) . . . Soviet crude line is moving into Poland (p. 83) . . . Second pump station boosts capacity of Hassi Messaoud (p. 83).

PLUS THESE TECHNICAL REPORTS: Avoiding shorts with test leads (p. 126) . . . How to purge a gas pipeline (p. 128).

Buyer Proration Ruling Awaited

. . . as Oklahoma Supreme Court begins study of contempt ruling and fine levied against Gulf for cutting purchases.

THE POWER of a state conservation commission to prevent a crude-oil buyer from prorating his purchases is before the Supreme Court of Oklahoma.

Arguments have been concluded in the long-pending case of Gulf Oil Corp. versus the Oklahoma Corporation Commission.

The commission argued that its conservation powers would be voided if a purchaser can prorate at will. Gulf argued that an order requiring a purchaser to buy oil violates the federal Constitution.

In August 1957, in the midst of the post-Suez crude glut, Gulf announced a cutback in its crude purchases in a five-state area including Oklahoma. It prorated all purchases by a flat percentage.

This came in conflict with a 1956 order of the OCC requiring all purchasers to take the full allowable from each well unless excused by a special order of the commission. Several other purchasers asked and received permission to prorate at that time.

Gulf didn't ask. It said the commission had no authority to make it buy oil it didn't want and couldn't use. The commission cited Gulf for contempt, fined it $305,000—$5,000 a day for 31 days. Gulf went to the federal courts, saying this was interference with interstate commerce. The U. S. Supreme Court refused to hear the case until state courts had passed on it.

The issues . . . In their arguments last week, Gulf's attorneys said the whole system of conservation will break down if the OCC order is upheld.

If one state can force a buyer to take more oil than he needs, he will have to curtail purchases in other states. Other states would then retaliate by requiring him to take still more crude. The result would be a badly glutted market and chaos in the industry.

The OCC's attorney said this was misrepresentation. The commission wasn't trying to make Gulf take oil it couldn't use. It probably would have given Gulf permission to curtail buying if it had asked and had given a good reason.

But, he said, the commission must have power to say how the curtailment is to be accomplished. The purpose of the order is not to tell buyers how much to buy, but how to apportion their buying equitably.

Other points in his argument:

. . . **The commission** must have the power to prevent wasteful, discriminatory taking of crude oil.

. . . **Purchaser proration** to an arbitrary percentage of a previous month's runs disregards allowables set by the commission, bears no reasonable relationship to the capacities of the wells, may injure water floods, ignores special situations which the commission would consider, and causes injury and waste.

. . . **It is futile** to attempt to regulate production in the interest of conservation without the power to require the ratable taking of crude.

. . . **The real issue** at stake is whether the commission has any regulatory authority over pipeline common purchasers of crude, whether they are common carriers and public-service corporations obligated to serve all producers equitably and to purchase all oil lawfully produced unless relieved from the duty by the commission.

OCAW Policy Group Sets Up Mandatory 18-cent Wage Boost

THE NATIONAL bargaining policy committee of the Oil, Chemical and Atomic Workers International Union has established an 18-cent per hour general wage increase as a mandatory policy.

The policy was established during a 2-day meeting of the committee in Denver last week.

O. A. Knight, union president, said the policy was established under terms of a constitutional amendment adopted by the 1959 convention. It becomes effective on ratification by 75% of the bargaining units affected.

"The committee decided to establish a flat cents-per-hour figure," Knight said, "because it felt that equity demanded it. Our past few wage increases have been computed on a percentage basis, and the committee feels it is time to provide a uniform pay raise for every member of our union in the industry."

In its statement establishing the policy, the committee said increases in cost of living and in productivity, both in the total economy and within the oil industry, justify the 18-cent figure. The wage increase was the only item made mandatory to bargaining committees by the policy committee.

Under terms of the mandatory bargaining program no local may sign a settlement unless it is approved by the policy committee.

Coal Research Set

. . . with short-range aim to boost coal's sales.

AFTER a false start a year ago, the coal industry is about to get a second government research effort started soon.

The Senate now has joined the House in voting for a bill to set up a director of coal research in the Department of the Interior. The program will start with $2 million a year.

The new program will aim at short-range research projects to improve mining, preparation and using of coal, in contrast to the long-range projects now conducted by the U. S. Bureau of Mines.

Backers of the bill explained that about two-thirds of the bureau's current research involves synthetic or gaseous fuels, and much of the remaining third is on other long-range problems.

Coal interests saw "little benefit" from these efforts, as the investment required for synthetic fuels or coal-to-gas plants is so enormous it is "extremely unlikely" the industry can find the funds needed.

A year ago, the Congress sent the President a bill for coal research to be done by an independent commission. The President vetoed it, saying the effect would be a "blurring" of government authority for coal research. The President suggested a new bill placing the job in the hands of the Secretary of the Interior.

Under the measure, the new office would "contract for, sponsor, cosponsor and promote the coordination of research with recognized interested groups, including but not limited to, coal trade associations, coal research associations, educational institutions, and agencies of state and political subdivisions of states."

The program foresees technical advisory committees to eliminate duplication of effort.

Secretary of the Interior Fred Seaton has promised to find $1 million of the first year funds for the new unit, and to come back to Congress for more early next year.

Contract Scouting Gains Momentum

• More traditional scout checks are affected as a third commercial venture gets started. And, in the Rockies, the first such service cuts fees 20%.

THE MOVE to contract scouting services is gaining momentum.

It was announced last week that Data, Inc., of Tulsa, will take over routine scouting work for 20 companies in a four-state area—Oklahoma, Kansas, the Texas Panhandle, and Arkansas.

There was another development, too: Well Record Service, of Denver, announced a 20% reduction in its $2,500 fee for full service. Those subscribing to partial service will also get the 20% reduction, providing the minimum is above $400.

Data, Inc., a subsidiary of Century Geophysical Corp., is the third commercial scouting organization to set up shop in 9 months. It spreads the program to 15 states. Twenty-nine companies are now on subscriber lists of the three contract scouting enterprises, with some of the companies subscribing to more than one service.

The other two organizations, in addition to the newest one, are Well Record Service, and Williams & Lee Scouting Service, Inc.

Well Record, which began operations last October, has 17 companies subscribing to its service covering 11 states. Williams & Lee has 16 clients in West Texas and eastern New Mexico. It began operations about 6 weeks ago.

The impact . . . The rise of the commercial scouting organizations, cutting in on the traditional practice of scout checks, has created a considerable stir of discussion in scouting circles (OGJ, Aug. 3, 1959, p. 44).

Clients of the newest service now participate in five scout checks—at Liberal and Wichita, Kans.; Fort Smith, Ark.; Oklahoma City, and Amarillo. The Williams & Lee service handles scouting work in areas served by Midland and Roswell checks, while Well Record Service operates in areas served by five checks—at Farmington, N. M.; Billings, Mont.; Bismarck, N. D., Casper, Wyo., and Salt Lake City.

Data, Inc., pattern . . . The newest entry, Data, Inc., came into being after an advisory committee had studied the scouting situation at length.

Fees, tentatively set, range from about $700 a month for the Oklahoma service to about $1,500 for all four areas.

Weekly reports will include intentions to drill, new locations, all active wells, and completion tickets. Too, there will be daily verbal reports on wildcats and key production wells for subscribers who call in.

General headquarters will be in Tulsa, headed by a chief scout and general manager. All reports, scout tickets, and standarized report forms will be prepared in and distributed from this office.

There will be operating offices at Oklahoma City, Wichita, and Amarillo.

The Oklahoma City office will have an area scout, clerical help, and three local scouts. Scouts working out of and reporting to Oklahoma City will be based in Tulsa, Ardmore, Enid, Shawnee, Duncan, and Fort Smith, Ark.

The Wichita office will include an area scout, clerical help, two scouts in Wichita and one each in Russell, Pratt, and Colby.

The Amarillo office will have a

scout in Liberal, Kans., and in Amarillo in addition to an area scout and clerical help.

Robert J. Riggs, Jr., who will head the Tulsa office, said that for each area covered, five subscriber-members will act as an industry advisory committee to set and to direct policies. The committees will determine policy on such matters as tight holes, relationships with other contract reporting services, and expansion of services or expanded distribution of data.

A meeting of the Oklahoma scout check advisory committee, with Don Hill, of Skelly Oil Co., Tulsa, as chairman, has been called for next week to authorize rules and regulations under which Data, Inc., will service clients.

Texaco Threatened by Strike

. . . as 90-day OCAW notice nears expiration. At issue are fringe benefits and contract maintenance—but not wages.

THE THREAT of a strike hangs over Texaco's refineries across the nation this week.

The chief unresolved issue: higher company contributions to hospitalization, medical, and surgical plans; increased early retirement benefits; and a curb on company use of outside maintenance crews.

The Oil, Chemical and Atomic Workers Union, which represents some 10,000 Texaco workers in eight plants, has not made wages a top issue in the current talks, although this may come later.

Bargaining is being handled at the local level for each plant, but union members as a whole are looking to the Port Arthur, Tex., local for guidance. The giant Texas refinery has 4,200 OCAW members.

Tensions were eased somewhat last week when the Port Arthur management made an offer on the health insurance issue, but there must still be some give-and-take before agreement can be reached.

The issues . . . The union's 90-day strike notice expires on the Fourth of July, but it can be extended by the union. A strike probably would require a vote of the membership.

At present Texaco is making monthly health insurance contributions of $1.32 for persons without dependents and $2.82 for those with dependents. OCAW is asking $2.50 (no dependents), $5 (one dependent), and $7.50 (more than one dependent). The company has offered $1.50 (no dependents) and $3.50 (one or more dependents).

A union spokesman said the company offer may be satisfactory, but he could make no prediction that it would be accepted.

The union also is asking that workers 55 to 65 years old be allowed to choose early retirement at a minimum of $100 per month, plus another $125 in lieu of social security. This is considerably greater than the present actuarial plan for early retirement.

The issue of contract maintenance crews currently is not acute, and the company has agreed that it will not lay off workers as a result of such a policy. The union, however, contends the company is not hiring replacements for persons who retire or quit work and is using contract labor instead.

"We are trying to stop that trend," a union leader said.

So far the Texaco talks have been conducted on a so-called "high level" and have not degenerated into name-calling.

New problem . . . However, a new, and potentially dangerous, issue was injected into the negotiations last week. OCAW employes at the nearby Jefferson Chemical Co. plant in Port Neches are on strike, and they are objecting to the use of feed stocks from the Port Arthur refinery for their plant, which has been placed on stream by supervisory employes.

Texaco, a joint owner of Jefferson Chemical, has a contract to supply the Port Neches plant, and Texaco manager E. W. McNealy said last week he is merely abiding by that contract.

Nearly 400 workers have been on strike at Jefferson Chemical since May 21. The issues involve working conditions.

Texaco has had no strike at Port Arthur for 8 years. It had a short strike in 1952 and a longer one in 1950.

OCAW hopes to obtain contracts for all the Texaco plants at the same time, although bargaining is on an individual plant basis. Elro Brown, regional OCAW director at Houston, is union coordinator for all the Texaco negotiations.

Other Texaco plants affected are in Tulsa, Long Beach, Calif.; Anacortes, Wash.; Casper, Wyo.; Bayonne, N. J.; East Chicago, Ind.; and Port Neches.

Gulf Tries New Tool

. . . in refinery lab. It's a 100-kv. spectrograph.

A NEW 100-kv. X-ray spectrograph has gone into operation at Gulf Research & Development Co.'s refinery laboratory in Philadelphia. It's speedier and more sensitive than its 60-kv. cousin, a common sight in many refinery labs.

Key virtue is that it can detect and analyze elements in oil samples down to 0.5 p.p.m. in less than 15 minutes. Older machines can detect only 3 p.p.m. and it takes much longer.

One important use: Gulf's laboratory can take a sample of catalyst and charge stock, analyze it in minutes, and advise refinery management the precise time a catalyst needs replenishing and with how much fresh material. Thus sensitivity and speed can add up to dollars and cents when dealing with expensive catalysts.

The designer, Philips Electronic Instruments of Mt. Vernon, N. Y., has built in important modifications over older instruments.

The highly sensitive "100" operates on a constant voltage, whereas the earlier "60" used a pulsating voltage. And, in earlier units, the operator spent considerable time changing and realigning instrument components when analyses for different elements were desired. Mechanical devices in the new X-ray instrument make these changes in seconds.

PROCESSING

An asphalt terminal with a storage capacity of 2,500,000 gal. is being built at Three Rivers, N. Y., on the New York State Barge Canal about 10 miles north of Syracuse by Atlantic Refining Co. William N. Ruppel, manager of asphalt sales, said the terminal will enable Atlantic to meet growing demands for highway grades in much of New York. John M. Lindfors, Jr., Philadelphia, has been named superintendent of the terminal, designed and being built by Badger Manufacturing Co.

An entirely new line of high-purity epoxy compounds is coming into the picture. This new family of petrochemicals results from the use of peracetic acid, now made commercially by Union Carbide Chemicals Corp. at Institute, W. Va. Peracetic acid is used to add an oxygen atom

U. S. Lease Fees Rise

. . . but overhaul of Mineral Leasing Act will permit larger leases and will clarify the ground rules on public lands.

OIL AND GAS leases on the U. S. public lands are going to cost more—50 cents an acre a year—but the rules about them will be clearer under a major overhaul of the Mineral Leasing Act being completed by Congress.

As it stands, both the House and Senate have enacted bills to make major changes in leasing provisions, and a conference committee is working to iron out some 27 differences in the two versions. Many of the differences are minor.

Already approved by House and Senate, are these provisions:

. . . **Rent for noncompetitive leases** will be 50 cents an acre a year, or $2.50 for 5 years and $5 for 10 years. Under present law, the rents are 50 cents an acre for the first year, none for the next two, and 25 cents for the final two.

The new rents are called "minimums" and may be increased by the Secretary of the Interior at his option.

. . . **Term of leases** is 10 years, compared with present rules which give 5-year leases, automatically renewable for another 5 years.

. . . **Maximum acreage** that may be held by one person in any one state except in Alaska, is 246,080 acres in leases or options, of which no more than 200,000 may be in the form of options. At present, the limit is 46,080 acres in leases and 200,000 in options. The change makes larger leases possible.

The maximum acreage in Alaska is 300,000 in leases and options north of the Tanana and Yukon rivers and an equal amount south of the rivers. Of the total, no more than 200,000 may be in options in the northern and southern leasing districts.

Senate backers of the measure pointed to a "potentially dangerous slackening in exploration for development of domestic reserves of oil and gas so necessary for our security in war and peace."

They said the measure "will remove certain legislative obstacles to exploration for development of the mineral resources of the public lands and spur greater activity for increasing our domestic reserves."

The measure is likely to cut down on paper work by the Bureau of Land Management, and thus on government costs, while it will add "substantially" to receipts.

The Senate Interior and Insular Affairs committee said it didn't think the higher rentals would slow down leasing.

By and large, the Senate changes from the House-passed version are additions. Here are the major ones:

The Senate put tar sands under the Mineral Leasing Act, and allows leasing of up to 7,680 acres in any one state, along the same lines as provided for oil shale leases, including rental of 50 cents an acre. The House measure was silent on this.

The Senate committee said this would give the U. S. "a vast new reserve of petroleum within our own borders" and pave the way for recovery of "many billions of barrels of oil."

The Senate also moved to protect seven persons who have filed for oil and gas leases on San Nicolas Island, off the coast of southern California. The Senate voted to give them priority in obtaining leases if leasing becomes "consistent" with military use of the area within 12 years. The applicants are to have no priority if the area is classified as a known oil area. The House was silent about this.

The Senate voted that only the grantee of an option need report to the Secretary of the Interior, while the House called for both grantor and grantee to report.

The Senate voted to exempt a person from being charged with holding acreage by virtue of stock holdings in a firm that holds leases and options, unless he owns at least 10% of the stock in the firm. The House measure would carry no such exemption.

The Senate voted for suspension of rentals and running of time against a lease when operations are blocked by a contest by the Secretary of the Interior; the House voted to extend time for the blocked period.

BRIEFS . . .

where a double bond exists in hydrocarbons. Union Carbide is already producing four new plasticizers, three epoxides, a textile finish and two chemical intermediates using the peracetic acid process.

Allied Chemical Corp. will build a low-molecular-weight polyethylene plant at Orange, Tex., costing several million dollars. This is the second polyethylene plant for Orange announced in less than 6 months. In January, Allied announced plans for a high-density polyethylene plant at Orange for completion in mid-fall (OGJ, Feb. 1, p. 111).

New research facilities costing $2.2 million will be built by Continental Oil Co. at Ponca City. Conoco plans to double the size of its present research laboratory, built in 1952, and provide space for 135 additional workers in the next 5 years. When finished in early 1962, the new facilities will bring Conoco's total research investment at Ponca City to $8.5 million and its staff to nearly 600.

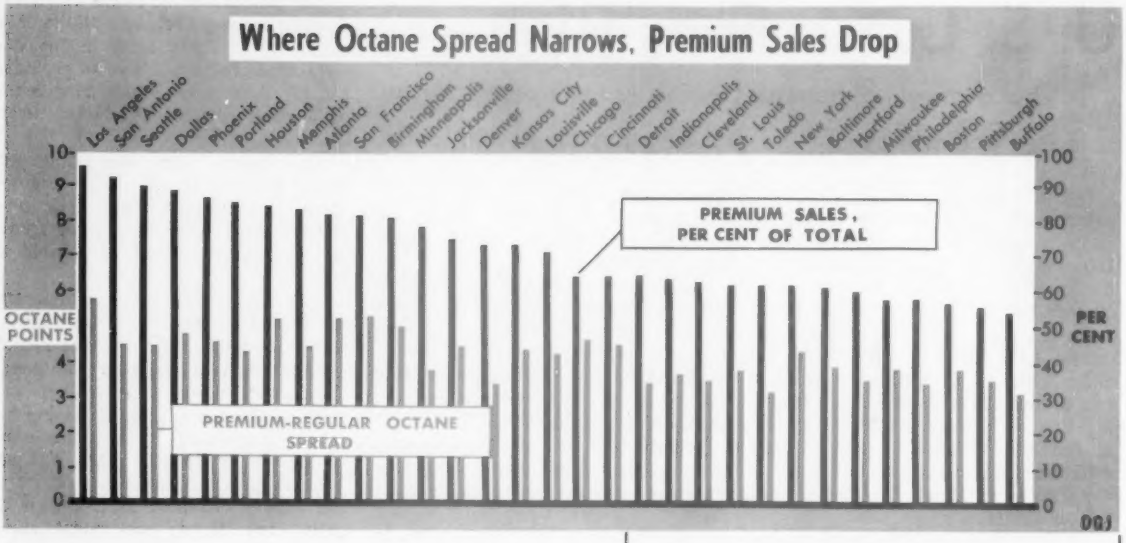
British American Oil will add a Udex aromatics extraction unit at its Montreal East refinery. Contract will be awarded in August and construction will begin in the fall. The BTX unit will produce benzene as prime product and may be used later for production of toluene and xylenes.

A fertilizer plant with an annual capacity of 50,000 tons will be built at Dominguez, Calif., by a new company set up by three existing companies. Involved in the plant are Shell Chemical, Stauffer Chemical, and Western States Chemical. The plant will be completed early next year.

Also for Refiners . . .

IN THE NEWS: Texaco threatened by nationwide strike (p. 64) . . . Rising quality of regular cuts premium sales and threatens profits (p. 66) . . . Imports-control program gets a new boss (p. 58) . . . Don't look for a cut in crude-oil imports this year (p. 69) . . . OCAW tells locals they can't settle for less than an extra 18 cents an hour this year (p. 62).

PLUS THESE TECHNICAL REPORTS: What refinery simulation involves at Phillips (p. 85) . . . Refinery cost index (p. 98) . . . Are depreciation allowances inadequate? (p. 99) . . . Quarterly Costimating (p. 100) . . . Quiz on fluid flow (p. 105) . . . Paint warns of dangerous hot spots (p. 118).



Is Regular Gasoline So Good It Hurts?

- **Further encroachment into premium field could shoot up refiners' costs, cut profits, give motorists more quality than they need.**

In the Chart...

You will note that premium gasoline sales (black bars) are higher in those cities where the difference in octane points (red bars) between regular and premium is the greatest. As the gap narrows, premium sales fall off.

This creates a knotty problem for refiners, who must decide whether to keep boosting the octane rating of regular grades.

John P. O'Donnell
District Editor

MORE THAN a few people in the oil industry fear that the octane race in regular gasolines will have an increasing impact on the cost of regular and on the sale of premium grades.

That is, the "incremental octane" is becoming as beguiling to marketers as the "incremental barrel" has been to refiners. And they suspect that the consequences could be pretty much the same, varying only in degree.

This fear is given substance by the narrowing spread between regular and premium octane quality (OGJ, May 16, p. 100). In January 1959 the spread was 7.5 numbers. By December, it was down to 6.9.

Upgrading regular faster than premium hits the company in two ways: It increases the cost of regular gasoline and reduces the sales of more profitable premium.

Those who point with alarm figure this cost the industry the equivalent of $75 million in 1959, including $30 million for the cost of the increased octane of the regular and $45 million as the loss in premium sales.

The trend to a narrowing gap between regular and premium has been going on for more than a year. Indications are that it will not only continue but may even accelerate. Here's why: Two years ago only 50% of the new cars were designed for regular. This year it's up to 75%. That obviously tends to turn a motorist to regular.

Cash-register impact . . . It is a proven fact that as the quality spread narrows between premium and regular, sales of premium decline. Since premium provides a better profit, the total return on the gasoline declines.

Here's one comparison:

In Los Angeles last December premium averaged an even 100.0 RON and regular, 90.3 RON, a spread of 9.7 octanes. During 1959, premium sales were 58.8% of service-station business.

In Buffalo, in the same month, premium averaged 99.8 RON and regular, 94.0 RON, a spread of only 5.4 octanes. During 1959, premium sales were 31.1% of the service station sales.

Thus in Buffalo, where the premium-regular spread was just about half what it was in Los Angeles, premium's share of service-station sales was also just about half.

The accompanying chart plots the premium-regular spread last December and the 1959 percentage of premium sales for 31 cities. It shows plainly and rather consistently that, as the regular-premium spread narrows, the percentage of premium drops.

The spread narrowed most sharply on the West Coast last year. There it narrowed by 1.6 octanes in contrast to the northeastern area where it narrowed by only .2 of an octane.

This is what had happened to service station sales on the West Coast in 1959:

. . . **California:** Premium's percentage dropped from 53.9 to 46.9%. This switch of 7.0% represented a drop of 13% in premium volume.

. . . **Oregon:** Premium's percentage dropped from 35.7 to 30.5%. This switch of 5.2% represented a drop of almost 14.8% in premium volume.

. . . **Washington:** Premium's percentage dropped from 39.2 to 31.9. This switch of 7.3% represented a drop of more than 18.6% in premium volume.

This decline continued through the first quarter of this year.

Costs involved . . . One market research team figures that the cost to the industry of raising regular from 88 to 90 octane at 0.42 cent per gallon. It considers both the increase in regular octane and the decrease in premium volume and comes up with this conclusion:

Cost of the octane could run about 0.30 cent per gallon for the regular. At this octane, sales would be about 50% regular and 50% premium. For a company selling 50% regular this cost would be equivalent to 0.15 cent per gallon of the entire motor gasoline volume sold, including both premium and regular grades.

Downgrading premium customers could be an estimated 11% as 88 octane provides 58% satisfaction and 90 octane provides 69% satisfaction. If the profit margin on premium sales is about 2.5 cents per gallon, the loss of this would equal 11% times 2.5 cents or about 0.27 cent per gallon of total gasoline sold.

Adding the 0.15 cent per gallon for the cost of the increased regular octane to 0.27 cent for loss in premium volume comes to 0.42 cent. With service-station sales at 61.3 billion gallons last year, total cost to the industry of raising regular two octanes at that level would be around $250-million per year.

Since refiners' profits have been scraping bottom for months, more than a little thought is being given to what should be done about it. Quite a few solutions are proposed, some of them involving radical departures from accepted practice.

Lower octanes? . . . One company says the regular octanes should be lowered, reasoning that the trend to regular is creating a "tremendous octane waste."

It cites this example: "In 1959 the average industry regular of 92.4 octane satisfied 80% of all cars on the road and over 60% of new cars on a light knock basis. The large bulk—or 85%—of these cars would have been just as well off with a 90 octane fuel."

It continues, "73% of the cars satisfied by 92.4 octane could have been just as well satisfied with 88 octane. The savings to the economy by a lower octane regular, with a few more cars using premium, could run into hundreds of millions." It obviously would like to see regular octanes cut back instead of going ahead.

This group estimates the changing premium and regular percentages of total sales as regular grade goes up in quality. It then applies the octane cost of the two grades, to the volume of each, and calculates a pool cost. Using this system, it concludes that the total pool cost goes through a minimum at about 90 octane. It finds that, as regular octane is decreased below 90, the premium per cent increases to such an extent that the cost of the pool increases.

"It is apparent," it contends, "that at the current 92.5 average regular octane, the industry is above the optimum by a considerable amount."

Increase price? . . . The refinery economics group of another company thinks that the thing to do is to increase the price of regular to offset the cost of its octane increase. This is contrary to past practice for the industry has historically absorbed the cost of octane increases.

This group comes up with a vastly different increase in pool cost. It figures it in this way:

An 88 RON regular costing 10.0 cents a gallon and a 96 RON premium costing 10.9 cents on a 50-50 basis equal a pool cost of 10.45 cents.

A 90 RON regular costing 10.3 cents with a 96 RON premium costing 10.9 cents on a 61-39 basis equal a pool cost of 10.5 cents.

The increased cost of the pool on this basis is 0.08 cent a gallon. If one cent is added to the retail price of regular to compensate for the two-octane increase in quality, the netback on the pool would more than cover the increase resulting from the quality improvement in regular and the loss of business in premium.

Regardless of which way the pool cost is figured, this group feels that a penny increase in the retail price of regular would result, at worst, in a tiny loss and, at best, in a fair profit. It is its contention that, following this idea, "the public benefits and the industry's costs are covered."

Add a third grade? . . . The engineering and technical center of still another company sees a solution in the addition of a third grade. Instead of being a superpremium, however, it would be a subregular. A general adoption of this practice would take the industry back to a pre-war status.

The center based its idea of a low-octane third grade on the results of an economic study that indicated that seven grades are needed to meet car requirements most economically.

Putting seven grades of gasoline and as many pumps into one station may not be very practical. A happier, less costly and more practical solution may be to go to three grades: A third grade, possibly four octanes under current regular, a regular and a premium.

The third grade, possibly 90 RON, would be good enough for about 70% of all cars. The regular, at close to 94 RON, would staisfy more than 85% and the premium, at 99 to 100 RON, would satisfy 97-98% of all cars on the road.

Even though its study showed seven grades as being desirable, this center does not favor the custom blending idea. It says that the pioneer in custom

Influence of Octane-Number Demand on Industry Refining Facilities

Year	Typical Gasoline Octane Levels		Investment for Balanced Refinery Operations for One Barrel Thruput Per Day	Major Processes Introduced Resulting in Higher Octanes
	Reg.	Prem.		
1920	45*		**$200**	Distilling
1925	60*	70*	**$250**	Thermal Cracking
1943	80	87	**$530**	Catalytic Cracking
1952	85	92	**$825**	Catalytic Reforming
1957	90	99	**$1,000**	Hydrotreating & High Severity Catalytic Reforming
1960	93	100	**$1,250**	Alkylation for Motor Gasoline

*Estimated

blending, according to published information, is selling better than 75% of its total gasoline at the minimum level. "We'd take a real licking," it says, "if our service station sales ran 75% regular and only 25% premium."

Eliminate grades? . . . A diametrically opposite eventuality is seen by an economist-statistician. He foresees the day that, if the present trends continues, premium and regular will become so alike in quality that, in effect, there will be but one grade.

The prospect of only one grade of gasoline is scoffed at by most marketing people. They stoutly believe that there'll always be a premium. The economist-statistician, however, comes up with this interesting point:

"It's pretty commonly accepted," he says, "that it takes about three octanes for a motorist to distinguish between grades. There are a dozen markets now where the highest quality regular is only four to five octanes below the average premium. That's getting close to the three octanes it takes to distinguish one grade from another.

"Furthermore," he adds, "in these same dozen markets, the difference between the highest quality regular and the lowest octane premium is, in one instance, as low as 2.5 octanes and in none is more than 4.5 octanes. That, too, is uncomfortably close to the irreducible minimum. In the area where the difference is only 2.5 octanes, a lot of motorists could switch from one supplier's premium to another's regular and not notice the difference."

Unused quality . . . Still another argument against increasing regular octane is the contention that it's making a lot of motorists pay for quality they don't need. In the northeast, regular averages close to 94 RON, good enough to satisfy 85% of the cars on the road. Against this, at the beginning of this year, fully 50% of the cars would have been satisfied with 86 to 87 octane.

Motorists who are buying a 94 octane regular but need only 87 are paying for seven octanes they can't use.

Where the blame lies is open to question. Oil points its finger at the automobile industry and the car manufacturers point right back. Right now, the responsibility rests mostly with the car manufacturers. They are putting out "economy" cars that, they say, will operate satisfactorily on regular. But it takes the highest quality regular and, in too many cases, even premium to satisfy many of the so-called economy cars.

That's the situation today but it was just the other way around a few years back. During the postwar boom and under the later stimuli of Korea and Suez, refiners added rapidly to capacity for quantity and quality. Then, generally speaking, the octanes were running ahead of the motor car needs.

In the five years from 1955 through 1959, the industry put a good $1.5 billion into catalytic reforming and alkylation alone. Now that the alkylate formerly needed for avgas is available for motor fuel, there is a lot of octane capacity available. One good indication is the low level of TEL use.

Just how much of a liability the "incremental octane" is or will be is a moot question.

It's another "management of surplus" problem that will need some of the elusive "industrial statesmanship" to make sure that the industry does right by itself, by its customers and by the automobile manufacturers.

Gas Lines Win Texas Tax Case

- State judge rules that levy on interstate lines has "the same general vice" as a previously outlawed tax.

TEXAS' latest effort to tax the long gas-transmission lines was knocked flat in the first round by a state court.

Judge Jack Roberts of the 126th District Court ruled in Austin that the so-called severance-beneficiary tax passed by the legislature last year is unconstitutional.

State attorneys announced that the decision will be appealed.

The tax—1½% of market value at the well-head—has piled up about $6,370,000 to date—essentially all of it protested and held in escrow.

Victors in the consolidated suit were these seven firms: Tennessee Gas Transmission Co., Transcontinental Gas Pipeline Corp., Michigan-Wisconsin Pipeline Co., Natural Gas Pipeline Co. of America, Northern Natural Gas Co., Panhandle Eastern Pipeline Co., and Permian Basin Pipeline Co.

The ruling, however, will apply to all other pipelines protesting the tax. And the measure, itself, provides that the tax will not apply to intrastate pipelines if it should be found unconstitutional for interstate firms.

A constitutional violation . . . Judge Roberts agreed with the pipelines that the levy violated the interstate commerce clause of the U. S. Constitution. He said he could see no local activity of the plaintiff pipelines upon which the tax could be legally upheld.

"I cannot escape the conclusion that this statute carries the same general vice as the gas-gathering tax" passed in 1951, Roberts said.

Roberts is the same judge who held the latter tax invalid. He was later reversed by appellate courts, which were in turn reversed by the U. S. Supreme Court.

Will Wilson, Texas attorney general, said the state will appeal the case contending Roberts erred in that the point of taxation is before the gas enters interstate commerce.

Wilson said the tax is basically fair. He said it seeks to correct "the present unequal situation in which some pipelines have a tax advantage by reason of early contracts fixing a low price—a price much lower than the present market price on which the present tax is calculated."

For instance, gas produced under a dedication contract fixing the sales price at 5 cents is taxed on a basis of 5 cents, even though its present sales value may be 17 cents. Gas on the very next lease, not dedicated and sold at market price, may be taxed on a basis of 17 cents.

The severance-beneficiary tax, Wilson said, would partially equalize this situation.

INDUSTRY

Gulf Oil Corp.'s acquisition of Wilshire Oil Co. of California has been confirmed. It had been rumored for the past few weeks that Gulf would move into the West Coast marketing picture through Wilshire (OGJ, June 27, p. 82). Gulf had controlled the company through another affiliate. Wilshire ranks eighth in gasoline sales on the West Coast. The company operates about 800 stations, most of them in California.

Texas Gas Transmission is seeking FPC approval of an underground gas-storage project in Kentucky's West Greenville field. The company would build a 29-mile, 12-in. line from the field to main line facilities near Slaughter, Ky., and a compressor station, dehydration plant, and meter station. Interest in the field would

Don't Look for Crude Import Cuts This Year

● Interior Secretary Seaton makes it clear that he isn't planning on any reductions, despite producer pleas.

INTERIOR SECRETARY Fred Seaton last week verified earlier speculation that the department is not planning any cut in crude-oil import quotas this year.

"Since quotas have been set, I would not anticipate any cutback at this time," he told a press conference.

Producer groups have been urging Interior to consider reductions as a means of bolstering sagging domestic oil operations. But Seaton obviously feels that the department has gone about as far in that direction as it should go at this time.

He said he thought the oil import control program has done a good job thus far of meeting the goals set for it, and he pointed to the fact that wildcat drilling up to May of this year was running almost up to the pace at the same time last year and a little ahead of the 1958 rate.

He said that while domestic production and prices are part of the over-all picture which Interior must consider, they must be classified as "corollary" interests of the program. The basic aim, he said, is to encourage an adequate rate of wildcat drilling.

Seaton conceded that the problem of the American oil industry is too much oil, but he said if all imports were shut off it would add only "two or three days a month to Texas production."

However, the secretary said, he is open to suggestions to improve the current control program. In his view, no better one has yet been suggested. Clearly, then, he does not consider the producer proposals for reductions as a means of improving the program now.

Views on other subjects . . . After discussing imports, Seaton touched upon other oil matters.

. . . Offshore boundaries. He pointed out that the determination of Louisiana's coastline in the Gulf of Mexico is up to the Department of Justice and the courts. Until this is settled, the state will not know the starting point for measuring the three miles of submerged lands it will control under the recent Supreme Court ruling.

Seaton said that disposition of the offshore money being held in escrow—more than $300 million—will have to await settlement of the coastline issue.

. . . On coal research. Interior is "all ready to go" on a $2 million a year research program as soon as Congress completes legislation on the subject.

. . . On helium, Seaton is "delighted" that legislation to spur construction of helium plants is well on its way through Congress. The U. S., he said, has the only helium in the free world, and possibly the only helium anywhere.

. . . On Puerto Rico, Seaton would "welcome" a new formula to replace the present one requiring the setting of crude quotas for that area.

Fred A. Seaton . . . knows of no better approach to import controls.

BRIEFS . . .

be purchased from Western Kentucky Gas Co., Owensboro.

Halliburton Co. is the new abbreviated name adopted by the internationally known Duncan, Okla., oil-service firm (OGJ, June 20, p. 84). Stockholders made the change official during the company's annual meeting last week.

Continental Carbon Co. has begun moving its headquarters to Houston from Amarillo. The company's new two-story building in suburban Houston is nearing completion and eventually will house 50 home-office employes. The switch will not be completed until July 1961.

Anchorage office of the U. S. Geological Survey will take over supervision of oil and gas operations on Alaska's federal lands. These operations had been handled through Los Angeles. Merwin H. Soyster is regional supervisor in Anchorage.

Texaco Experiment, Inc., is new name of Texaco's high-energy fuels research subsidiary, Experiment, Inc. The company, main government-research contract arm of Texaco, will do research and development work for the Defense Department.

Trial of the LPG salt cavern storage suit, brought by Sid Richardson interests against Pan American Petroleum Corp. and Skelly Oil Co., is scheduled to begin July 11 in federal court at Amarillo. The suit asks payment of one-eighth cent a gallon for all LPG withdrawn from salt storage by the companies in Hockley and Carson counties, Texas, since 1957, triple damages, and an injunction against further withdrawals. The oil companies claim the methods of storage described are not patentable.

Continental Oil Co. has bought a 25% interest in Carlon Products Corp., world's largest producer of plastic pipe. Continental's line of chemicals includes plasticizers used in the manufacture of plastic products, and the company currently is completing a plastics evaluation laboratory at its Ponca City, Okla., research and development facilities. Carlon's principal plant is at Aurora, Ohio. Other plants are at Corsicana, Tex.; Asheville, N. C.; Compton, Calif.; Somerville, Mass.; and High Springs, Fla.

North Dakota Industrial Commission has set record high allowable of 61,434 bbl. per day for the state in July. Previous record was 61,309 bbl. per day in April.

Oil "Barometer" Is Falling

- **PESA is told 1959 sales of equipment and services were off 22%. Wilson sees still lower volume in 1960.**

ONE BAROMETER of the petroleum industry's economic status—oil equipment sales and services—indicates that stormy weather is continuing.

Statistics released last week at the annual meeting of the Petroleum Equipment Suppliers Association tell the story:

The dollar volume of equipment and services in 1959 was about 22% less than in 1957.

The 1959 consumption of both carbon and alloy steel is down substantially from 2 years ago.

Domestic shipments of oil country goods dropped about 25.6% from 1957 levels.

Exports in 1959 were close to those of 1958 but well below the 1957 totals.

Some of the figures obtained in a survey by the Department of Commerce are preliminary and incomplete. But they were complete enough to show that the "barometer" has been falling.

In dollar terms, it is estimated that the volume of equipment and services in 1959 amounted to approximately $900 million.

This is borne out by Wallace D. Wilson, president of PESA, who estimates that sales in the first quarter of 1960 have been running even lower than in 1959. And he expects that level to continue through the first half of the year—with some prospects for an upswing in the last half.

Wilson thinks now that earlier forecasts of 51,000 wells in 1960 were too high. Currently, he says, 46,000 to 47,000 wells appears to be a more accurate guess.

The PESA notes that there were 50,893 well completions in 1959 with a total of 208,250,000 ft. The average depth was 4,092 ft.—73 ft. less than in 1958.

The Commerce Department's survey, made with the cooperation of the PESA, also shows that Houston, Tulsa, Los Angeles, and Dallas-Fort Worth retained the relative positions they held in 1957. Houston led in dollar volume with $328,520,000 out of a total of $860,659,000 in sales and services.

New officers . . . In last week's annual meeting, held at Banff, Canada, the PESA elected Elliott Johnson as president and John G. Seiler as vice president.

Johnson, from Houston, is vice president of finance and general counsel of the Schlumberger Well Surveying Corp. He has been with the firm since 1936.

Seiler, from Louisville, Ky., is president of Tube Turns, a division of Chemetron Corp. He joined Tube Turns in 1930, and moved through a number of positions until he was selected as president in 1956. He is also a vice president and director of the parent corporation.

Elliott Johnson . . . new president

John G. Seiler . . . new vice president

IRS Eyes Drilling-Cost Rule

- **Proposed regulations apply to an operator's deduction of intangible drilling costs; industry has objections.**

INTERNAL REVENUE Service is studying a proposed regulation on intangible drilling costs that could have a serious impact upon thousands of oil and gas producing operations.

As proposed, the regulations do two things, among others:

They make clear that an operator with rights over the full payout period of an oil and gas well can deduct his full share of the intangible drilling costs, whether 100%, 50% or something else.

They would limit the operator's right to deduct these costs when his interest, either full or partial, continues for less than the full payout period. In such cases, the IRS proposes that the operator's right to deduct the costs be based on "his share of such interests immediately after the complete payout period."

Oil and gas officials told the IRS at a recent hearing that the second part of the proposal is "entirely unfair" as it could deny an operator the right to deduct some of his costs.

Oscar Neuhaus, chairman of the tax committee of the Independent Petroleum Association of America, suggested, instead, that the operator's share of the costs be based upon "his anticipated share (determined at the time such costs are incurred) of the operating net income during the complete payout period."

Neuhaus also suggested that either a voluntary disposition before payout or an option to acquire during the payout period be "disregarded" if it was not economically sound to exercise the option.

IPAA said it "approves the general approach," but prefers a "fractional interest concept" to the "all or nothing concept" in the proposal.

IRS proposes that the regulation be retroactive to 1953, but some officials indicated that the government may make it apply only to the future.

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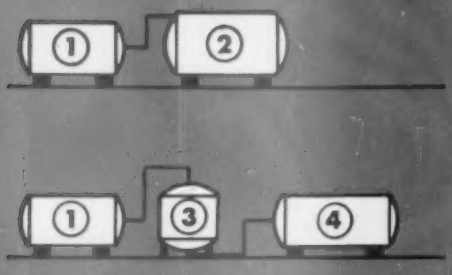
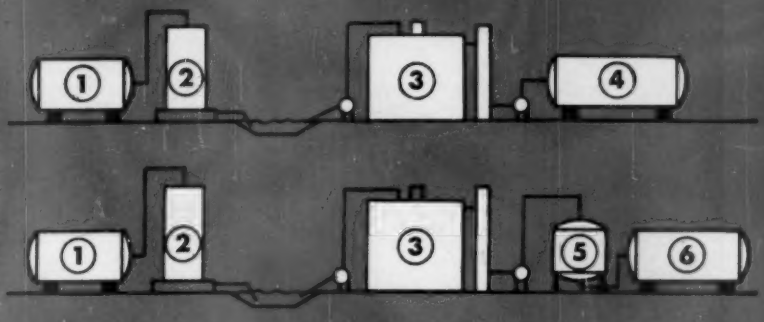


1. Oil Skimmers
2. Filta-Wash
3. Filters
4. Backwash Tanks

OR AN **OPEN SYSTEM?**



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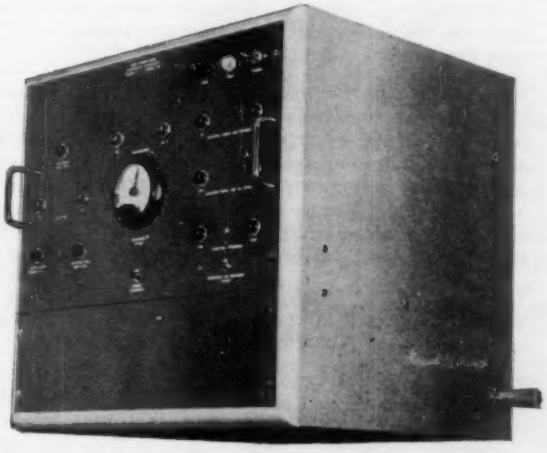

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Louisiana Keeps Output Level

. . . but it's counting heavily on its multiple-completion restrictions to bring down the volume of new production.

LOUISIANA is holding its depth-bracket allowable at the same percentage level for July and August with the hope that its new curb on multiple completions will slow down new production.

Production from newly discovered wells will boost July-August production by 23,568 bbl. daily over May's average. This is the trend which Louisiana seeks to stop with a ruling that only one allowable will be granted wells completed in new fields.

"We hope this will have some effect, and our new production will be substantially less," Chief Engineer Tom Winfiele of the conservation department said last week.

The allowable order, issued by Commissioner Ashton Mouton, set production at 34% of March 1953 base period. This is the same as for May and June and should produce 961,738 bbl. daily for the coming 2 months. This includes the 23,568 bbl. of the new-well production.

Some "discussion" . . . Winfiele said the order on multiple completions has created considerable discussion in the industry, although most persons have been concerned mainly with understanding exactly what it provides. The department has now issued a formal order to replace an oral order issued earlier by Mouton.

"Oil men all recognize that we had to do something to control production, but whether or not they are accepting this particular plan, I don't know," Mouton said. "Anytime you reduce allowables, some one has to be affected by it. There is a hurt here, but the hurt is shared by all segments of the industry having multiple completions.

Hardest hit by the order are offshore operators who have been making multiple completions as a means of getting a payout on high-cost operations in the Gulf of Mexico.

Winfiele said no one has sought a hearing to rescind the order but that the matter will be reviewed at the next public hearing of the conservation department August 10-11.

Whether the restrictions can be lifted or changed depends on production and demand, Winfiele said. "I hesitate to say what we will do in the next 40 or 45 days."

Another development affecting Louisiana allowables also is developing.

More spacing credit? . . . Within the next week Mouton expects to make an announcement concerning industry proposals to grant higher allowables to wells drilled on wider spacing (OGJ, May 30, p. 64).

The announcement may involve a tentative order or merely a statement of intent. Mouton expects to hold at least one more public hearing before establishing any permanent order.

Several top producers in Louisiana proposed in May that companies get proportionate increases in allowables by spacing wells in excess of the present basic 40 acres. They would suffer decreases, with certain exceptions, if they drill on less than 40 acres.

At that time Mouton asked for briefs from advocates and opponents of the plan, and half a dozen have been submitted. Opposition came from groups of royalty and land owners.

A state official last week indicated that no "complete answer" to the questions raised by wider spacing has been devised but that some procedures may be developed that will provide such an answer ultimately.

"We hope to crystallize our thinking and, in some manner—by order or announcement—give our thinking to the industry," the official said. "We don't believe we are ready to write a final order."

Agencies Oppose TBA Bill

• Government trust-busters join industry in opposition to Roosevelt's 3-pronged attack on marketing practices.

MAJOR OIL companies and the federal Government teamed up last week to blast a bill which would forbid commissions to oil refiners on tires, batteries, and accessories sold at their service stations.

It was the first hearing on the bill, HR 9894, although Rep. James Roosevelt (D.-Calif.) has been introducing it for at least 4 years.

The measure was so clobbered it may have trouble getting off the ground next year. This week's hearing, before a House commerce subcommittee, was designed to stir things up for an all-out try in 1961.

Three oil company officials called it "reckless and unwise" and "revolutionary and drastic" as well as "dangerous and far reaching."

They said the record shows no proof that oil companies coerce their dealers to handle sponsored brands of TBA products and that complaints from dealers are "negligible."

Otis H. Ellis, counsel for the National Oil Jobbers Council objected, too, fearing that independent marketers might later be forced out of TBA sales.

Department of Justice called it "special legislation" without a showing of need and said the antitrust laws are "adequate" to meet any problem.

Its comments also applied to Roosevelt's second bill—to keep refiners out of retailing of gasoline and motor oil as well. Justice said "nothing would be gained" by Roosevelt's third bill, either, which would require oil refiners to file with the Federal Trade Commission copies of their leases with dealers.

FTC called the measure "undesirable" and "dangerous to the public interest."

Commerce Department called them "unsound," adding that the laws of economics make producers deal fairly with their dealers.

Roosevelt called it a "further implementation" of the antitrust laws needed because of the "tremendous pressure" upon dealers to handle sponsored brands of TBA. The present situation is "deplorable" he said.

Tennessee Gas May Buy Independent Dallas Oil Firm

TENNESSEE Gas Transmission Co. is negotiating to buy Renwar Oil Corp., a Dallas independent which owns about 2,700 bbl. daily crude production and two gasoline plants.

Outcome of the talks between the two companies may be known this week.

Renwar has most of its production in Southwest Texas and has operations headquarters at Corpus Christi.

The company has gasoline plants on Mustang Island, Nueces County, near Corpus Christi, and at West Rockport in Aransas County. The Mustang Island plant has a capacity of 50,000 M.c.f. daily and the West Rockport plant 14,000 M.c.f. daily.

New Gas Sources Studied

• California utility executive takes a look at alternate supplies needed to meet "ravenous, growing" demand.

SYNTHETIC gas from shale oil, liquid methane, or pipeline gas from Mexico and the Gulf Coast may some day serve the gas-utility market in California.

These new sources of energy for the West Coast were cited recently by W. M. Jacobs, vice president of Pacific Lighting Corp., in an address to the International Oil Scouts Association in Los Angeles. Pacific Lighting is the parent of three gas companies which serve the southern California market.

Gas manufactured from shale oil may be the best bet for a new energy supply. Jacobs said the shale-oil deposits in Colorado could yield "more than 10 times as much gas as all the presently estimated natural-gas reserves in the U. S." Gas converted from coal may also be a future source.

Jacobs said economic factors are delaying any move to transport methane to California at the present, but methane is considered a likely source once natural-gas supplies are exhausted or the price of gas rises too high.

Making the long pipeline haul from the Gulf Coast to California is a definite possibility, Jacob said. He pointed out El Paso Natural Gas Co. has applied to the Federal Power Commission for certification of a 30-in. line to tie El Paso's West Texas system to gas supplies in south Texas and the Gulf Coast.

"We keep an eye, too, on the possibility of importing gas from Mexico," he said.

The utility executive said California has a "ravenous and growing appetite for energy." About 75% of southern California's gas demand is met from out-of-state sources. These out-of-state sources are moving about 1¼ billion cubic feet of gas daily to Pacific Lighting affiliates subsidiaries.

Legal Opinion Clouds Arizona Activity

AN OPINION challenging validity of 1959 oil and gas regulations has clouded drilling and producing operations in Arizona.

Attorney General Wade Church advised the Arizona Oil & Gas Conservation Commission the 1959 rules, providing minimum 80-acre spacing for oil wells, are invalid because of insufficient public notice before adoption last year.

The commission will meet July 27 to determine if it will appeal the ruling. A friendly test suit may be filed. Notices of the 1959 regulations were published in the Arizona Weekly.

D. A. Jerome, Phoenix, executive secretary of the commission, said it would continue to issue drilling permits and producing orders under the 1951-52 regulations. These authorize drilling on 40-acre spacing.

"Those receiving permits during this interim period will be advised of the chances they may be taking and urged to use their own judgment on how to proceed," said Jerome. Six permits currently are being processed. Some expressed fear the confusion over regulations might halt all new drilling.

M. F. Wharton, Phoenix, commission chairman, said the board will move for a speedy decision clarifying the muddle. While some viewed the reason for invalidation as "a mere technicality" and having nothing to do with merit of the oil and gas rules, others said oil operators stood to lose if they began drilling on 40-acre units, only to have the 80-acre pattern upheld later.

Ten wells now are drilling in Arizona under permits previously issued. Jerome said these would not be affected.

New Wildcatting in Montana

THEY'RE going to try again in Montana's Disturbed Belt, the southeast extension of Alberta's prolific gas-producing Foothills Belt. One wildcat is being drilled and another has been staked.

Great Northern Drilling Co. is drilling at 1 Two Medicine Hat, 6 miles east of Glacier Park town in SE NW 19-31n-11w, Glacier County. The wildcat is slated for the Madison-Mississippian at 9,500 ft.

The hole is being drilled on a farmout from Union Oil Co. of California. If it is successful, Montana Power Co. will take over at casing point on a bottom-hole purchase basis.

The location—in the vast Disturbed Belt where only one commercial well has ever been completed—is about ½ mile southeast of Union Oil's 1 Morning Gun. That 9,559-ft. Madison hole flowed 6,000 M.c.f. daily and 250 bbl. of condensate during tests several years ago, but production declined sharply and the well was abandoned.

In addition to the wildcat try by Great Northern, Superior Oil Co. has staked location for a 12,700-ft. Madison test at Chief Mountain in C NE SW 19-37n-14w, Glacier County. That well is in the 23-19 Blackfeet tribal.

Arctic Permits Let

. . . for exploration on 44 million acres. Some U. S. firms included.

PETROLEUM exploration permits have been issued for more than 44 million acres in the far-north Arctic islands and offshore Canadian waters. Some of the permits went to U. S. firms.

Permit issuance was the climax to a rush of applications which began early in 1959. However, of the original bids put in for 146 million acres, more than two-thirds were dropped when the deadline was reached recently.

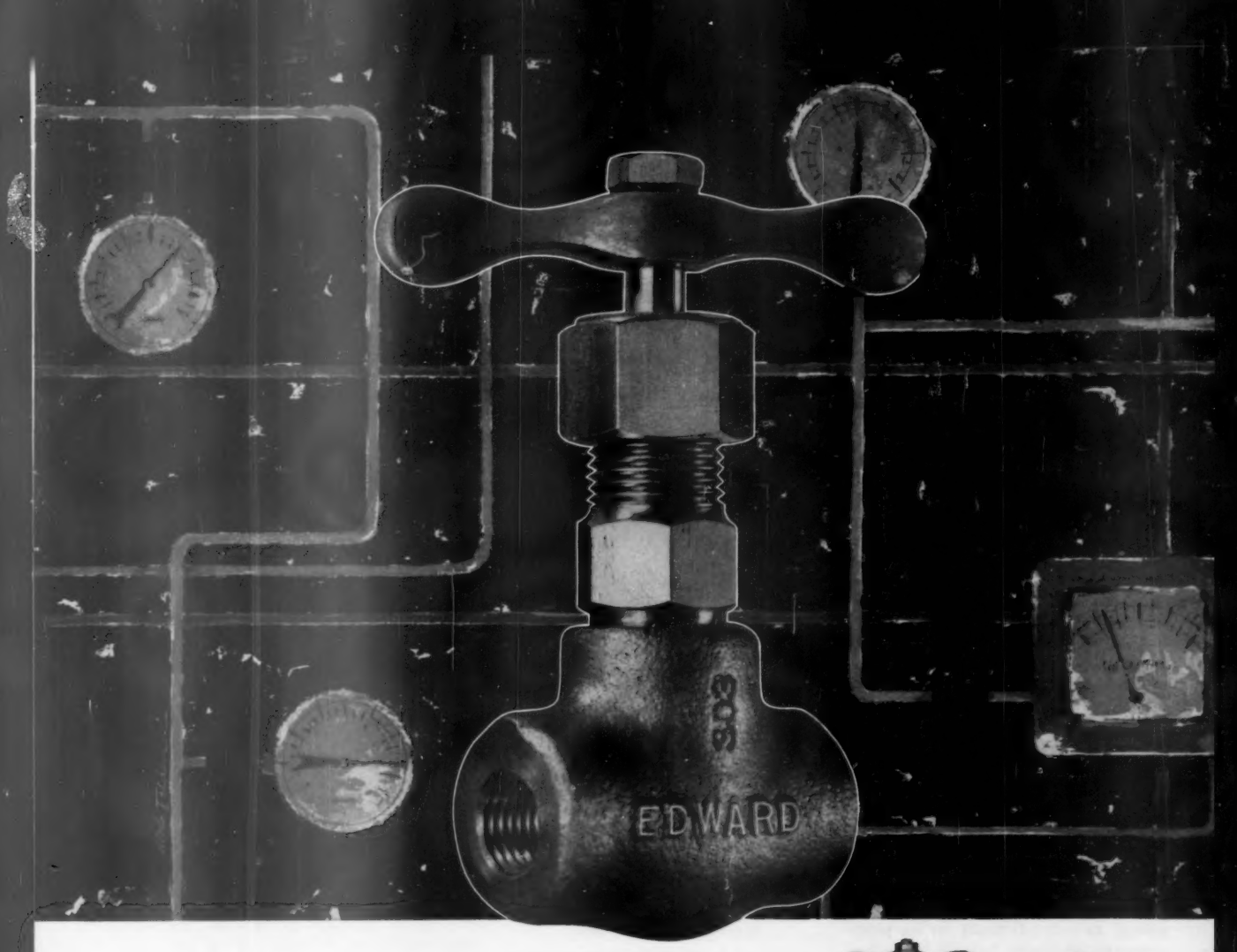
One attraction in the Arctic is low-cost exploration. This is offset by high drilling costs—which may be as much as $1 million a hole initially—but that cost would drop once as more wells were drilled.

Resources Minister Hamilton gave this breakdown on permit: Of the 44 million acres involved in the 12-year exploration grants, 39,046,000 acres are in the archipelago; 1,100,000 acres are off the Queen Charlotte Islands; about the same in the Sable Island area off Nova Scotia, and 2,200,000 acres are off the mouth of the Mackenzie River.

U. S. firms got 8,600,000 acres. Texaco Exploration Co. led with 3,152,319 acres. Standard of California obtained 2,297,427 acres.

The biggest chunk of land on the list, however, was granted to Cree Oil of Canada (1958) Ltd.—4,450,000 acres. Dominion Explorers Ltd., another Canadian firm, followed with more than 4 million acres.

Oil companies retaining rights for the full 12 years are obligated to spend a minimum of $3 an acre. This includes an initial $250 permit, an expenditure of at least 5 cents an acre on exploration within the first 3 years, 25 cents an acre during the next 3, and increased amounts for the remainder of the permit period.



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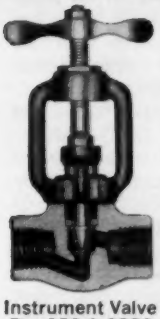
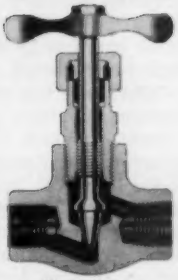


Instrument Valve
Fig. 952 & 2952
6000 lb WOG



Gage Valve
Fig. 152 & 4152
4000 lb WOG

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Castro's Militia Takes Texaco Refinery

• Shell, expecting similar treatment, stops crude shipments to its Cuban refinery. Esso, the third major refiner which refused to process Soviet crude for Fidel, can also see the handwriting on the wall.

FIDEL CASTRO shipped two barges containing 25,000 bbl. of Russian crude across the Bay of Santiago to Texaco's 20,000-bbl. refinery last week in a power move to force the American company to process the oil.

When Texaco refused, Castro's militia seized the refinery.

Shell de Cuba didn't wait for Castro to move. The following day Shell notified the government that it will no longer ship Venezuelan crude into its 27,000 bbl. Havana refinery. There was no immediate move by Esso Standard which has a 36,500 bbl. plant at Havana. But it is only a matter of time. Castro is almost certain to seize the other two refineries.

Shell said last week its action was based on "purely commercial grounds." The company explained that Cia. Shell de Venezuela has been willing to extend credit to its sister company in Cuba but the debt has mounted to $17 million with no dollar payment by the Cuban government since May 10, 1959.

"Obviously this situation could not continue indefinitely," Shell said.

Shell explained that it had refused to refine the Russian crude because of the historical "interdependence" of its group of integrated companies. Running Soviet oil in the Cuban refinery would "harm the economies of nations such as Venezuela and other producing countries to which oil revenues make an important contribution."

Large claim . . . Augustus C. Long, chairman of Texaco which has operated in Cuba for 50 years, says his company's claim against Cuba will be at least $50 million. The seized refinery at Santiago de Cuba is probably worth $20 million of the total with blocked funds, terminal facilities and retail outlet investments accounting for the balance.

The showdown between Castro and the American oil company came a short time after the revolutionary Cuban leader told an early morning rally of sugar workers that he will take over all American property in Cuba "penny by penny" if the U. S. cuts sugar purchases.

Texaco Chairman Long

. . . Action is not entirely unexpected.

When he made this statement to the cheering throng, Castro had already signed a decree ordering the takeover of the Texaco plant unless the company changed its mind and processed the Russian crude.

"We have consistently advised the Cuban government that we cannot agree to run in our refinery crude oil from sources other than our own," Long said in New York.

All three of the refiners have been supplying Cuba's market with crude from their own affiliated companies in Venezuela.

Dollar holdout . . . "In addition to what we consider an improper and illegal request to purchase and refine Russian crude, the Cuban government has failed to provide the dollar exchange to pay for imports.

"In fact, deliveries made over 15 months ago remain unpaid," Long said.

Texaco's chairman said the Cuban government refused to provide the dollar exchange for imported oil unless the companies agreed to buy Russian crude. The three refiners have an estimated $60 to $65 million tied up in the Cuban National Bank which they have not been allowed to take out of the country.

"Business conditions in Cuba under the Castro regime have gradually be-

Libyan Extension Gets Big Oil

OASIS OIL last week completed a 11,500-bbl.-daily well to break the recent humdrum of Libyan oil action.

The company's F-9 on Block 32 is the third biggest well ever completed in Libya. Only Esso Libya's Zelten 1 and 2 are larger.

The F-9 is in the southeast corner of Block 32. It is a further extension of the company's Dahra field. The well is 2¼ miles southeast of F-2 which tests 8,000 bbl. daily.

Forty-degree gravity crude flowed through perforations from a 40-ft. section from 3,066-3,106 ft., and a 10-ft. section from 3,120-30 ft. Total depth is 3,374 ft.

F-9 is the company's eleventh oil or gas producer completed in Dahra field since the initial F-1 came in at 30 bbl. per hour last year.

The latest success comes at a time when the three partners in the operation, Ohio Oil Co., Amerada Petroleum and Continental Oil, are operating under a new corporate setup—Oasis Oil Co. of Libya, Inc.

The 11,500 bbl. daily produced from F-9 compares with 17,500 bbl. daily and 15,000 bbl. daily from Zelten 1 and 2.

come more and more intolerable and this action on the part of the Cuban government is not entirely unexpected," Long said, in what is probably the understatement of the year.

Two-month squeeze . . . Castro began his pressure campaign against the three refiners early in May when he "offered" them 900,000 tons (about 6,300,000 bbl.) of Russian crude this year. When they refused, he warned they would have to take the consequences unless they changed their minds (OGJ, June 13, p. 82, and June 20, p. 95).

The "offer" of Russian crude was coupled with an offer to whittle away at the foreign exchange deficit that has been piling up for months. All three companies wrote the government they would be happy to accept the second offer, but not the first.

The Texaco chairman said last week that Cuban officials claimed the island's "combustible minerals" law of 1938 compels refineries to process the "petroleum of the state."

Long said Cuba apparently considers the Russian oil, which it gets in exchange for sugar, to be petroleum of the state. Long does not, nor do the other two refiners.

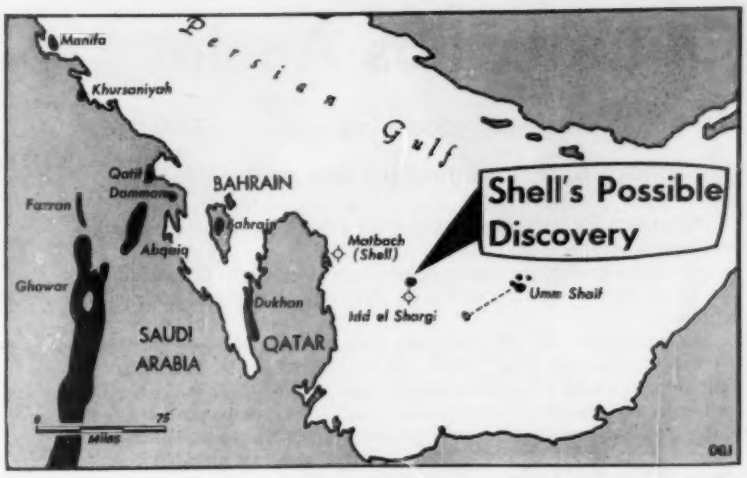
European reports . . . At almost the same time the explosive situation began to erupt in Cuba last week there were indications in Europe that Castro had some second thoughts about bucking the international oil industry, but found he was already in too deep to back out.

The Cuban ambassador to London was granted asylum in the Argentine Embassy in Havana last week after being "dishonorably dismissed" from his diplomatic post for trying to find a way out for his boss.

Sergio Rojas Santamarina flew from London to Havana a week ago with what he apparently thought was a plan to get Castro out of his uncomfortable position. He was fired for his pains and had to take refuge in the Argentine Embassy.

About the beginning of June, Rojas began contacting international oil circles in London, apparently on instructions from Havana. He was exploring some way that the Russian oil contracted by Cuba could be handled. His plan was to persuade a "neutral oil interest" to handle the Soviet oil for Cuba.

He aroused enough interest in Europe that several groups had agreed to at least discuss the matter with Castro. And Rojas flew off to Havana to present his plan to the Cuban boss. A few days later word reached London that he had been fired.



Shell Has Persian Gulf Show

• The company may finally have an offshore strike. Its first test in this area was more than 5 years ago.

SHELL CO. of Qatar, the first company to try to find oil under the waters of the Persian Gulf, may have finally succeeded.

Officials of the company admitted cautiously last week that they are testing oil found in the Middle Jurassic in a wildcat being drilled 52 miles east of the Qatar peninsula.

Pending results of the testing the company gave no details except to say it would be impossible to assess the value of the find without drilling more wells on the structure.

If the Shell company has found a commercial field it may start collecting on its more than $21-million investment in the marine-drilling operation which started more than 5 years ago.

The new well, Idd El Shargi No. 2, was spudded earlier this year with a new Netherlands-built mobile platform called the "Seashell." The new $5-million unit replaced a platform which the company lost in a freak Persian Gulf storm more than 3 years ago.

The company has drilled two dry holes on the subsea concession it holds from the Shaikh of Qatar. The first, Matbach 1, was the first marine drilling operation in the Eastern hemisphere. It was abandoned as a dry hole at 6,706 ft.

The second test was the Idd El Shargi 1 on the same structure now being tested with the new platform. In this well the company tested some shows found in the Upper Jurassic, but the well produced only small amounts of oil. It was abandoned in December 1956.

The Middle Jurassic shows found in the second well are interesting from a geological standpoint. Rocks of this period do not produce oil anywhere in the Middle East except for the one-well Fadhili field of Saudi Arabia which has never been on production. The prolific pay horizons in Saudi Arabia are mostly Upper Jurassic.

To the east, the new Umm Shaif field now being developed by the British Petroleum-Cie. Francaise de Petrole, produces from Lower Cretaceous.

U.K. Demand Shows Big Gain

BRITISH oil consumption has topped another rung on the ladder with a 21.7% gain in the first quarter which pushed demand above 900,000 bbl. daily.

U. K., one of the countries closely watched as a key market in an era of crude surplus, used 11,218,835 long tons of products the first 3 months, or about 920,000 bbl. daily. This does not include bunkers used by ships engaged in foreign trade.

Demand was up more than a million tons, or 82,000 bbl. daily over the preceding quarter. It was up more than 2 million tons, or 164,000 bbl. daily, over the first quarter of last year.

Fuel oil paced the growth with a gain of 31.1% to about 380,000 bbl. daily. On a tonnage basis, the product accounted for 44.4% of all deliveries. Another 62,000 bbl. daily was used as refinery fuel.

Output Slips Again

- **But crude-oil producing rates in French Sahara and Argentina set new all-time highs.**

RECORD CRUDE production in the French Sahara and Argentina bucked the April trend.

As a result, these countries helped keep free world output outside the U. S. above 10 million barrels daily for the fourth consecutive month.

Argentina hit 146,500 bbl. daily and Algeria, 126,100 bbl. daily.

Other countries raised their production rates. In Saudi Arabia output went above 1.2 million barrels daily. Indonesia's rise to 426,000 bbl. daily was the result of a record 212,500 bbl. daily production by Caltex. Stanvac produced about 82,600 bbl. daily; Royal Dutch-Shell averaged about 118,000 bbl. daily; and the government says it made about 13,700 bbl. daily.

Advances in these countries almost cancelled the effect of crimped flows in Venezuela, Canada, Iran, Iraq, Kuwait; and the U. S.

TREND OVER THE LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total free world outside U.S.
1959			
April	3,931.8	4,648.0	9,425.9
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,914.8	4,532.5	9,293.2
August	3,862.1	4,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,069.6	4,688.2	9,629.8
November	4,123.2	4,820.7	9,877.9
December	4,218.5	4,682.0	9,861.5
1960			
January	4,316.5	5,065.3	10,334.7
February	4,389.5	4,986.5	10,313.2
March	4,164.3	5,146.3	10,350.4
April	4,058.3	4,925.9	10,046.4

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	April 1960	March 1960	April 1959
Western Hemisphere			
Argentina	146.5	138.9	118.8
Bolivia	8.0	8.0	8.6
Brazil	76.0	76.0	66.7
Canada	493.4	558.2	446.4
Chile	18.9	18.9	17.1
Colombia	156.8	155.2	147.7
Cuba	0.3	0.5	0.6
Ecuador	7.8	7.8	7.9
Mexico	263.5	263.5	271.2
Peru	52.2	52.2	46.9
Trinidad	119.1	119.4	109.1
Venezuela	2,715.8	2,765.7	2,690.8
Total	4,058.3	4,164.3	3,931.8
Europe			
Austria	46.2	45.8	46.3
France	37.9	36.5	29.8
West Germany	106.8	105.1	100.5
Italy	29.0	31.0	32.1
Netherlands	35.4	34.9	33.4
United Kingdom	1.7	1.7	1.7
Yugoslavia	11.5	13.9	11.8
Total	268.5	268.9	255.6
Middle East			
Bahrain	45.0	45.1	45.1
Iran*	974.0	1,071.0	872.0
Iraq†	926.5	938.3	811.3
Israel	2.0	2.0	2.0
Kuwait	1,459.3	1,600.2	1,580.7
Neutral Zone	131.0	128.0	114.8
Qatar	171.0	179.5	172.4
Saudi Arabia	1,210.6	1,175.3	1,043.1
Turkey	6.5	6.9	6.6
Total	4,925.9	5,146.3	4,648.0

Country—	April 1960	March 1960	April 1959
Other Asia			
British Borneo	110.0	110.0	107.0
Burma	10.5	10.5	11.2
India	8.5	8.5	8.5
Indonesia	426.8	405.3	350.0
Japan	10.0	8.9	6.8
New Guinea	4.0	4.3	4.8
Pakistan	5.9	5.9	6.2
Total	575.7	553.4	494.5
Africa			
Algeria	126.1	123.4	13.5
Angola	1.2	1.2	0.8
Egypt	57.6	59.2	58.9
Gabon	15.0	15.4	14.1
Morocco	2.1	2.1	1.9
Nigeria	16.0	16.2	6.8
Total	218.0	217.5	96.0
Free World			
Foreign	10,046.4	10,350.4	9,425.9
United States	7,071.0	7,128.0	7,256.0
Total	17,117.4	17,478.4	16,681.9
Communist Countries in Soviet Orbit			
Romania	231.0	231.0	229.0
Russia	2,843.0	2,843.0	2,490.0
Others	100.0	100.0	60.0
Total	3,174.0	3,174.0	2,779.0
WORLD TOTAL	**20,291.4**	**20,652.4**	**18,460.9**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,500 bbl. daily from Naft Khaneh field, operated by Iraq Government.

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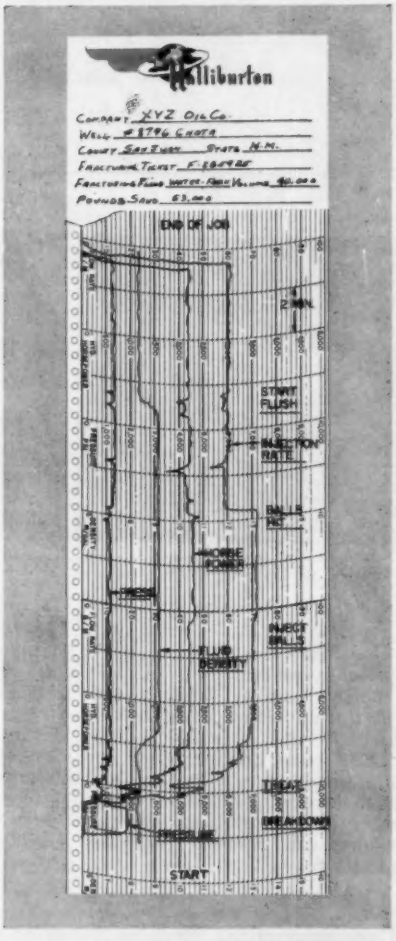

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Halliburton's new *FRACOMETER* is a pneumatic instrument providing remote indication and recording of flow rate, wellhead pressure and hydraulic horsepower during fracturing. The DENSOMETER reports ratio of sand to fluid in terms of total fluid density.

HERE'S WHAT IT DOES!

With this instrument team, you can constantly follow the fracturing operation involving flow rate, pressure, horsepower, fluid-to-sand ratio and total gallonage. With this record at your fingertips, you can determine needed treatment modifications immediately.

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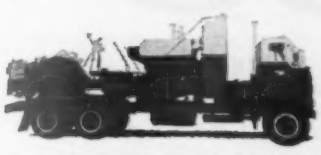
Many major companies as well as independents have made exhaustive field tests to determine the value of the Fracometer/Densometer Instrument Team. Over 100 successful job performances have led customer after customer to express their complete satisfaction with its operation and accuracy. On your next fracturing job, specify Halliburton's advanced AUTO-FRAC* and *see* the results yourself *as they are being made.*



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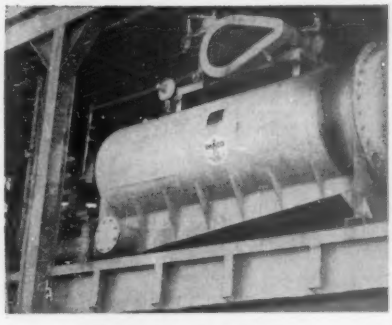
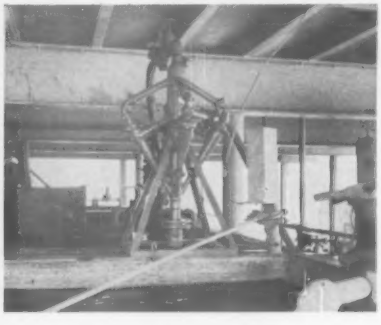
Three good ways to cut drilling costs

The three units shown here are important items behind the recent revolution in drilling fluids that has done so much to speed drilling and cut costs. Each is designed for a different problem but all are efficient and economical. Equally important, all are handled by SWACO -- the leader in mud-treating equipment.



SWACO D-GASSER®

Operators frequently report saving the entire rental cost of a D-Gasser on a well in less than a day.
When mud is gas-cut, the D-Gasser saves money in many ways. It cuts time lost for circulating after trips. It reduces barite costs, it minimizes lost circulation costs and problems. It maintains mud pump efficiency and it actually makes possible the close control of mud weight and viscosity that results in faster drilling with increased safety.



CLAYJECTOR®

If you are using mud as heavy as 12 pounds per gallon, you can cut mud costs and increase drilling rate by using a Clayjector. This is a cyclone-type separation unit that is extremely effective at rejecting unwanted clays and retaining expensive barite.
In addition, since it makes possible the economical maintenance of a low-solids, low-viscosity mud, it actually permits a reduction in bit costs and drilling time.

D-SANDER®

The D-Sander greatly increases the life of mud pump parts and bits when sand or abrasive shale is being drilled. Since it removes virtually all sand-sized solids from the mud, excessive pump-parts and bit-nozzle wear — as well as many other problems — are avoided when a D-Sander is used. There is a size and type to fit every rig and drilling condition.

These descriptions tell just a few of the many ways you can cut costs by mechanical mud treating. For the full story on how you can profit, call your nearest SWACO representative or write us direct.

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Australia's Roma Area Gas Field Gets Bigger

- **The latest hit is the biggest in the area, and possibly the continent.**

THE TITLE of Australia's biggest gasser may go to a Queensland well.

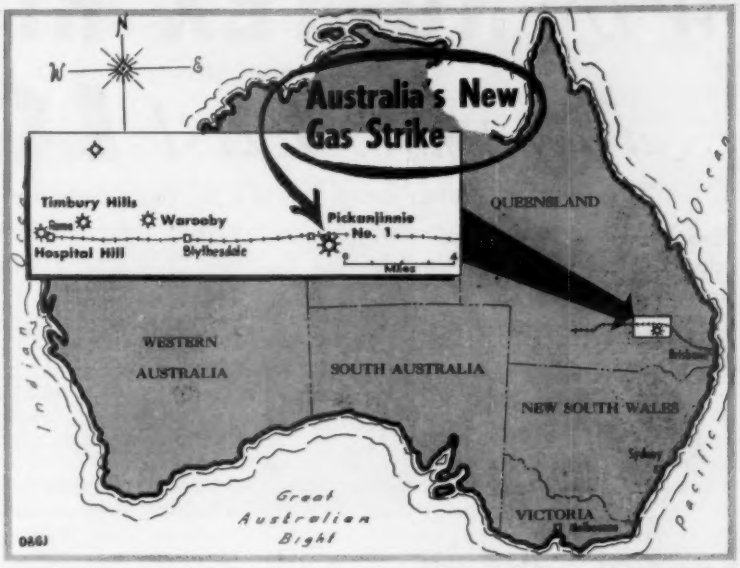
The Pickanjinnie No. 1, an apparent extension of the Roma gas area, flowed 2½ million cubic feet daily on a 40-minute test. The flow, the largest recorded in Queensland, came from an 18-ft. zone at 4,007 ft. Bottom hole pressure was 1,800 psi.

If the Associated Australian Oilfields well holds up, it will be the continent's largest gas producer.

Earlier this year an equal flow was gaged on the Port Campbell No. 1 in the Otway basin of Victoria on a drill-stem test. However, the well later went to water and was abandoned.

Earlier this year, Associated Australian Oilfields drilled another well in the Roma area—the Timbury Hills No. 2. Between 3,700 and 3,733 ft. this well was tested and produced at the rate of 1¼ million cubic feet per day.

Another well at Hospital Hill is capable of making more than 1 million cubic feet daily and a fourth at Warooby can produce better than 500 M.c.f.



The market . . . The Roma gas is more than 300 miles away from its best market—the southeast coast of Australia. Over 80% of Australia's people live in this coastal area between Brisbane and Adelaide.

There are climate extremes in this populated zone. At present the people heat their homes with coal or artificial gas generated from coal. One natural-gas system could serve the whole area.

The Regional Electricity Board has already expressed an interest in the Roma gas as fuel for a power station at Roma. Petrochemical manufacturers in Brisbane who now get raw materials from refineries and overseas comprise a ready market for gas products.

It has been estimated that the present demand for natural gas in Australia is about 1 billion cubic feet per day.

FOREIGN BRIEFS . . .

The West German company drilling in northeastern Syria has brought in a moderately successful stepout to its Suwaidiyah discovery. Concordia, a Deutsche Erdol subsidiary, tested Suwaidiyah 2 at 180 bbl. daily from a 755-ft. pay zone topped at 1,630 meters, or about 5,350 ft. The first well tested about 580 bbl. daily from a similar section topped at 5,620 ft.

India plans to start formal talks with Pakistan soon over the possibility of importing natural gas from Sui field into India. Preliminary studies by India indicate a pipeline to Bombay, on the northwest coast, might be commercially sound.

A new Yugoslav oil field is producing about 6,000 bbl. daily from 50 wells. Output from Struzec field, in Croatia, is moved to a refinery at Sisak through a new 10-mile pipeline. Further development drilling is expected to increase output to 12,000 bbl. daily in 1961. Reserves are estimated at 25 million tons, or about 175 million barrels.

A natural-gas discovery in northern Netherlands has tested 8.75 million cubic feet daily through a 9 mm., or about a 3/8-in., choke. A joint Royal Dutch-Shell and Jersey Standard company, NV Nederlandse Aardolie Mij., made the find in Delfzijl 1, near the Ems River, 16 miles northeast of Groningen. Flow is from the Zechstein formation at about 2,900 meters, or 9,500 ft.

A 24-in. 468-mile pipeline linking southeastern Saharan oil fields and a Tunisian loading terminal at La Skhira has been completed. Two pump stations now under construction are expected to be completed in time for Edjele, Tigentourine and Zarzaitine crude to be moving to market by October. The fields are being developed by CREPS.

Prospecting parties will be sent to Spitsbergen Island this summer by American Overseas Petroleum and Royal Dutch-Shell. Odd Birketvedt, governor of the Norwegian island, said the two companies are seeking exploration rights.

Fire Fighter Myron M. Kinley returned to Houston from Japan last week after putting out a shallow gas-well fire in the Nagoya District on southern Honshu Island. Kinley poured 50 tons of mud into the hole after moving the crumpled drilling rig with a crane. Teikoku Oil Co. was the operator of the well, which blew out at 400 ft.

A synthetic methanol plant will be built at Grangemouth, Scotland, by British Hydrocarbon Chemicals. Construction contract has been awarded to a local subsidiary of Chemical Construction Corp., New York. Chemical Construction also will build one of the largest hydrogen plants in Europe at Lyon, France, for Soc. Rhodiaceta.

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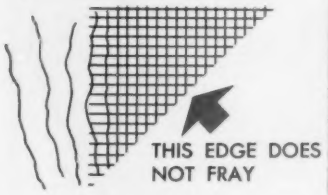
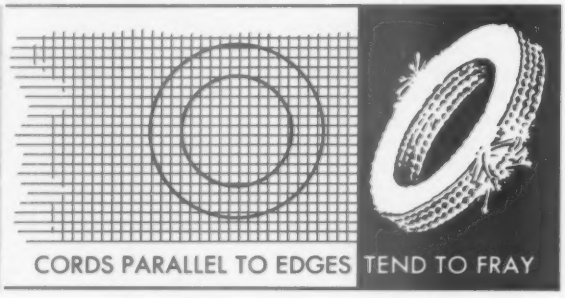
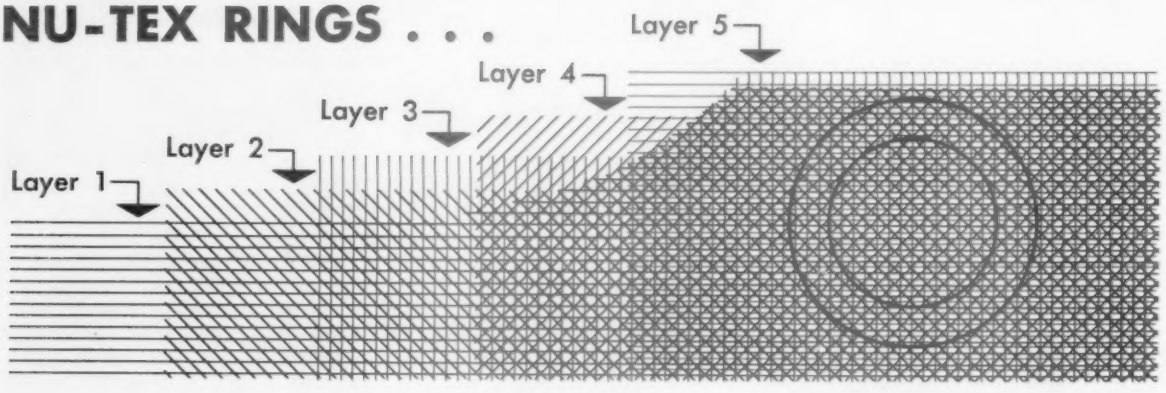


Ordinary rings are punched from belting stock with cords running only two directions . . . even though in several layers.



Special Fabrication with cords running FIVE DIRECTIONS provides uniform strength and rigidity on all edges of

NU-TEX RINGS . . .



Wear resisting crossed cord ends at all points on circumference of NU-TEX ring prevent crumbling and fraying of edges — insuring long, uniform wear of complete ring.

Controlled sizes assure maximum pump efficiency and ease of load on rod string. No grabbing or scoring action as occurs with metal to metal in dirty wells.

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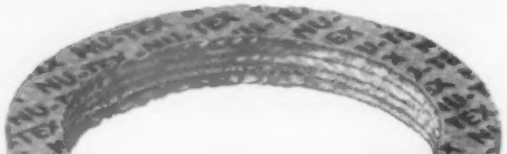

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Big Pipelines Awaiting Bids

. . . in Argentina and Libya. Argentina wants an operator and financier; Libya needs a big-inch gravity-flow line.

SOME of the world's foremost pipe-laying companies are sharpening their pencils in response to calls for tenders issued from Argentina and Libya, where two of the year's biggest foreign projects are gaining headway.

Argentina's state-owned YPF is seeking bids for construction, finance, and operation of a $300-million, 1,000-mile 30-in. natural-gas line from Comodoro Rivadavia to Buenos Aires.

In Libya, Esso Libya has issued a call for bids on a 100-mile 30-in. crude line from Zelten field to the Mediterranean Sea.

Argentina . . . The Argentine project, by far the larger, is for a system initially delivering 350 million cubic feet daily from Patagonia to the Buenos Aires area. Compressor stations with a combined total of 200,000 hp. are planned for the first stage. Throughput will be stepped up to 525 million feet later.

An unusual feature of the project is that the financially pinched Argentine Government, instead of offering outright cash payment, is looking for a builder willing to serve as operator for the system. The builder-operator would receive a toll on every cubic meter of gas transmitted for an indefinite period.

Reports from Buenos Aires are that a joint bid is being readied by Dresser Industries, as materials supplier, and Texas Eastern Gas Transmission Co., as operator. They are expected to submit a proposal for the entire project by the November 4 deadline.

Competition may be offered by Italy's ENI, in combination with Italian pipe and equipment manufacturers. A German group, headed by Ferrostahl, also may submit a bid.

Libya . . . At least eight companies are studying Esso Libya's call for bids for its pipeline from Zelten oil field, which will enable the Jersey Standard affiliate to be the first company to put Libyan crude on the world market.

The work will be relatively simple, consisting of laying a field gathering system and 100 miles of pipe to the coast. The winning bidder will not be responsible for bringing line pipe ashore, or for building pumping facilities. The crude will flow by gravity to sea.

Bids must be submitted within about a month, and the award will be made soon after. The entire system is to be completed within a few months.

Esso surveyors have been mapping a proposed route for several months. Land mines left over from World War II still are a hazard in the area, and nine clearance teams are going over the route with a fine-toothed comb. They promise a clear path by the time pipe-laying starts.

The first load of pipe has been shipped from England aboard the World Jonquil. The 40-ft. sections will be plugged at either end with plastic disks and floated ashore at Marsa Brega, where there are no wharves, piers, or quays.

Small, outboard-motor boats will haul the pipe to a flat-top carrier on rails built into the water. Pipe deliveries are expected to continue into November.

Hassi Messaoud Line

. . . is moving more crude to Mediterranean now.

CRUDE from Algeria's big Hassi Messaoud field is moving to the Mediterranean Coast at a faster pace.

The capacity of the 24-in. line from the field to Bougie has been boosted 45,000 bbl. daily to a total of 165,000 bbl. daily with the addition of a second pump station near Biskra.

To handle the higher volumes, Soc. Petroliere de Gerance (SOPEG) is constructing a new berth at the Bougie terminal with two loading points. One of the loading points is expected to be completed this month.

Prior to the opening of the line (OGJ, Dec. 14, p. 66), crude from the field was moved north to Touggourt by a 6-in. line and from there to Phillipeville by rail. Now that the Biskra pump station is in service, the baby line has been closed.

Another SOPEG project, a gas line from Hassi-R'Mel field to Arzew is now under construction.

Soviet Crude Line Moves Into Poland

BIG-INCH PIPE is moving into Poland as work speeds up on the 2,500-mile crude carrying system being built to supply eastern Europe with Russian crude.

The northern branch of the "Comcon" system will supply refineries in Poland and East Germany. A southern branch will feed plants in Czechoslovakia and Hungary. The line is expected to deliver 80,000 bbl. daily by 1962, with volume to increase to much greater levels later.

A foreign trade paper published in Prague says the Russians will price crude delivered in Czechoslovakia on world market prices, plus 50% of the average transportation cost for crude shipped from the Middle East to Hamburg.

HOW EMPHASIS ON COMMUNICATIONS SERVES HOUDRY CUSTOMERS

When you contract for technical service, or seek information on Houdry processes, catalysts or chemicals, a unique business communications system is immediately put at your disposal.

The effect is that your initial contact with any one section of Houdry's technical sales and service group also makes available the knowledge and experience of the *whole* group.

For instance, if you are primarily checking properties, availability, etc., of a catalyst, but would also like to check out some ideas for process changes, you can get the additional service promptly through the closely knit internal communications channels of Houdry's technical sales and service organization.

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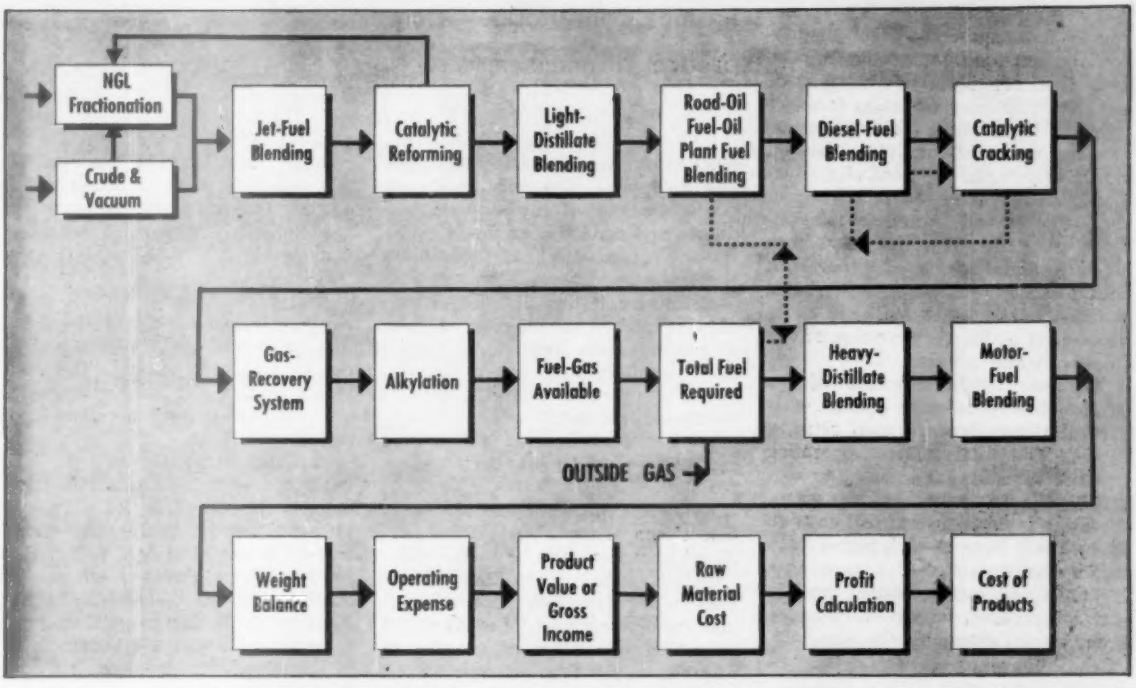


FLOW OF **CALCULATIONS** in a typical simulation follows this pattern. Fig. 1.

• Computer programs have been developed for four of Phillips' refineries. Here's a step-by-step explanation of the case-study approach, showing . . .

BY E. W. MILLS

. . . assistant director of the operations analysis and evaluation section, refining department, Phillips Petroleum Co. He has been with Phillips for 23 years, including stints at the Phillips, Tex.; Okmulgee, Okla.; and Kansas City, Kans., refineries. Mills holds a chemical engineering degree from Oklahoma State University.

What refinery simulation involves at Phillips

THE WORDS "refinery simulation" are fairly new to the petroleum industry and were brought about by the use of electronic computers for solving problems concerning refinery operations. Each person using these words does so in a very broad sense or has in mind a particular flow pattern of calculations.

There are at least two methods that are being used to simulate refinery operations. One method is the use of a linear program and the other is the use of process-flow calculations. The choice between these two methods is decided by the desired objective.

The mathematical model which simulates the operation of a refinery can be simple or complex depending upon the detail desired, flexibility of the refinery, level of knowledge concerning the dynamics of operations, level of knowledge of mathematics, and size of computer available. Phillips uses an IBM 709 computer located in Bartlesville, Okla.

. . . **Linear programing** for the direct maximizing of profits seems on the surface to be the ideal tool for use by the economist. There certainly is no argument against the use of linear programing for optimization if

the basis for the numbers entering the program is realistic. The most obvious limitation imposed by linear programming is the requirement that the objective function and statements of boundary conditions be capable of expression in linear-equation form.

While the mathematician often astonishes us by his ability to develop linear transforms of nonlinear functions, there remain too many important process and economic relationships which still defy satisfactory linerarization. Problem simplifications, introduced to enable us to describe the process by a set of linear equations, tend to impair the value of the linear-program solution.

The one reliable measure of the profitability of refinery operations is the difference between total refinery income and total refinery operating expense including the cost of raw materials. We do not know of any meaningful basis for assigning real costs to each activity level of each process step throughout the refinery. Unit operating costs and product values used in a linear program are arbitrary and a procedure to determine the sensitivity of the solution to changes in the cost factors is necessary.

Case study. It is seldom that operations can be scheduled to operate for maxium profits. Often the problem is to make a fixed product at minimum cost. From a practical standpoint, especially where more than one refinery is involved, and storage and transportation facilities must be taken into consideration, the step-by-step refinery simulation for case study produces more usable information for a given amount of computer time.

Again from a practical standpoint, operations analysis and evaluations should not only supply management with the necessary economics, but it should also provide detailed guidance for each step in the operation of the refinery.

The use of process-flow calculations to simulate total refinery operations avoids the explanation and examination of complex mathematics before plant personnel can use the simulation; dynamics of individual unit operations can be expressed accurately and in detail; simplifying assumptions to linearize operations or limit the size of the simulation are not required. Process-flow calculations can include optimizing techniques and linear programs as a part of the total program wherever desirable.

After considering many factors we decided our objectives would be met most nearly by the process-flow-calculation method. As the simulations are to be used by many people for all types of studies concerning individual unit operations, total refinery operations, blending of motor fuels, distillates and residuals, crude-oil evaluations, scheduling of operations, preparation of budget estimates, level of reforming, values of sales or purchase of special stocks, costs or value of products, etc., they should include every detail of operating a refinery

"It is seldom that operations can be scheduled to operate for maximum profits. Often the problem is to make a fixed product at minimum cost."

The simulations should be easy to use by anyone familiar with reifnery operations. Input-output data should be identified in familiar terms. Output data should follow the form of regular reports covering operations, so that a comparison of actual and predicted operations can be made easily.

Results from process-flow calculations in the case-study approach permits the determination of many points describing the effect of changes in variables, rather than determining one point which is a maximum or minimum of some function. In this way we know how far from optimum dollars the operations may be, and in some instances the difference may be slight for a more conventional method of obtaining the desired product distribution.

Some mathematicians will be quick to point out that, for example, a series of cases involving increments (say 2,000 bbl. per day) of crude throughput provides a number of points for a curve, but does not provide the optimum, since it is mathematically possible to have a sharp break between two points.

Experience shows that results can be considered as smooth curves as long as the increments are reasonable, unless a minor change in throughput results in the shutdown or startup of a major piece of equipment. Examination of the printout will show such changes. The total solution allows more insight into a problem, offers an opportunity to check the computer for accuracy, and the results are more easily explained to others.

Calculations performed by the computer are in more detail and vary considerably from the desk calculator. Optimization techniques replace trial-and-error systems, linear programs are used for blending of products, and equations obtained from regression analysis of operating data replace shortcut methods of calculating yields. An attempt is being made to prepare mathematical models of the more complex units in sufficient detail so that, when it becomes desirable to acquire the necessary hardware, in-line computer control can become a reality.

Flow of Calculations

Fig. 1 indicates the flow of calculations performed by a typical simulation of a Phillips refinery. The simulation for each individual refinery may vary from this flow depending upon actual operations.

... **Crude units** can vary the boiling range of the individual fractions or yield streams. This flexibility leads to complications, as there can be innumerable combinations. Rather than have a library covering all possible combinations of yield volumes and qualities we decided to standardize on a certain type of crude breakup.

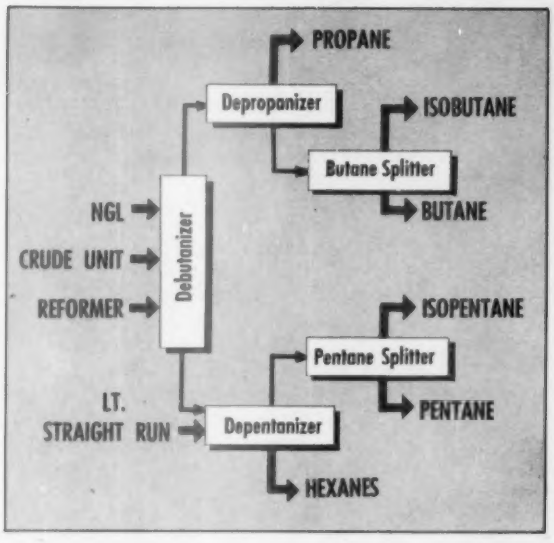
The simulation is directed to use this breakup and then to vary the boiling range of the various streams from the crude unit to accomplish any desired type of operation. The volume and characteristics of yield streams are shown on the printouts.

Characteristics of the various straightrun-gasoline streams include vapor pressure, octane numbers both clear and ethylized for motor and research methods, gravity, sulfur, and certain distillation points. Characteristics of distillates, gas oils, and vaccum bottoms include gravity, sulfur, distillation points, pour, carbon residues, viscosities, and cetane numbers.

The simulation of the crude and vacuum units contains factors which correct the volumes and characteristics of the yield streams as increases in throughput exceed equipment limits. When two crude units are charging different crudes there is a procedure to optimize the yield of the heavy distillate streams for minimum requirement of cutting stock.

The volume of natural-gas-liquids charge to fractionators (Fig. 2) is given as input data along with the liquid volume per cent of the individual components. This charge is blended with yield streams from the crude-unit deethanizer and the Platformer deethanizer to obtain total charge.

Yields are calculated for each tower, the tower loading checked and natural-gas-liquids charge reduced if any overload exists on any one of



TYPICAL fractionating system for natural-gas liquids. Fig. 2.

the towers. Final printout includes the volume and composition of each tower's yield stream along with certain characteristics, charge rate to each tower, and the maximum possible charge rate to each tower with feed of the calculated composition.

Jet fuel. Blending is accomplished by a linear program. Values are placed on individual components to either optimize the blend or drive the various components into the blend for case studies. The printout shows desired volume, specification limits for gravity, vapor pressure, and sulfur; the volume made and the calculated gravity, vapor pressure, and sulfur; the volume and per cent in the blend of each component, and the characteristics of each blend component.

Cat reformer. Operation is guided by specifying the octane number of the reformate. Two levels of operation can be specified along with a required volume at one of the levels.

Yields can be obtained from either an average yield curve or from equations which include characteristics of the charge stocks. If the charge volume calculated by the computer is greater than unit capacity times the stream factor, then the yield of reforming stock from the crude units is decreased and the yield of light straightrun increased.

Natural-gas-liquids fractionator yields are then recalculated. The final printout shows charge rates, characteristics of charge stocks, volumes, volume per cent of feed, and characteristics of the yield streams for both levels of operation.

Light distillate blending. We vary boiling range of the aviation turbine fuel, kerosine, and stove oil for the type operation desired. This is accomplished by use of values for optimization or to drive specified-boiling-range products to final blends.

Residual blending. Road oils are blended by formula. Fuel oil is blended from vacuum tar and a variety of cutting stocks which we may specify.

Normal specification viscosities, either Saybolt Universal or Saybolt Furol, are given on the input-data sheet. The computer converts these viscosities to kinematic viscosities, as they provide a unit applicable to all stocks used in blending. The simulation blends the components to specification, then converts kinematic viscosity of the blend to either Saybolt Universal or Furol viscosity for the final printout.

The blending method is a mathematical expression of the ASTM viscosity-blending chart. This expression was developed by Phillips and has an accuracy of 0.2 seconds Universal in the distillate range and 4.0 seconds Furol in the fuel-oil range.

Diesel fuel. An estimate of diesel base that is required for the diesel-fuel blends is placed on the input-data sheet. The computer uses this estimate for a starting point. The remaining diesel base plus heavy gas oils is charged to the catalytic cracking unit and the characteristics of the light-cycle oil calculated. Diesel demands are then blended using the estimated volume of diesel base, the light-cycle oil and other specified blend stocks.

If the estimated volume of diesel base is too much or too little to exactly meet specifications, the volume is adjusted with corresponding changes in the volume of feed to the catalytic cracking unit. The characteristics of the light-cycle oil are adjusted for the change in volume and characteristics of the feed to the catalytic cracking unit. This cycle is repeated until the blends are exactly on specification.

Four grades of diesel fuel are blended simultaneously. Some of the characteristics calculated for the blend are gravity, viscosity, distillation points, pour, and cetane number. Flash point is controlled by limiting the use of certain stocks to a specified maximum.

Catalytic cracking. Regression analysis was performed on operating data to obtain equations for predicting yields from the catalytic cracking unit. These equations include some of the more significant properties of charge stocks, unit operating conditions and properties of the catalyst. The program uses the equations in a looping analysis, generating some of the unit operating conditions, the conversion, and the yields.

The looping analysis checks for equipment limitations with the exception of compressors. A flash-vaporization calculation for the main fractionator accumulator is made to determine this load. If an overload exists, adjustments are automatically made on the conversion if feed rate is not allowed to vary.

The printout includes a description of the unit operating condition, yields expressed in barrels, volume per cent of feed, volume per cent of conversion and weight per cent of feed, and characteristics of the individual yield streams.

Gas recovery. At present the gas-recovery system is represented by a simple calculation which recovers light ends based on recovery factors. Products not recovered are yielded to fuel gas. The printout shows the volume and composition of each stream from each operating unit that is charged to the recovery system, recovery factors, and the volume and composition of each yield stream.

Alkylation. Feed for the alkylation unit from the gas-recovery system is composited with any outside feedstocks. Yields of either motor-fuel alkylate or aviation alkylate are calculated, taking into consideration unit capacity, stream factor, isobutane purity, and isobutane-to-olefin ratio.

Fuel gas. Production of fuel gas from operating units and from the

gas-recovery system is composited to obtain the total volume available.

The heat required for each operating unit has been calculated at this point and total heat required is obtained. Steam required for various operations is obtained and the heat required to produce the steam is calculated. Total heat required is compared with the total heat available. If there is a shortage of heat the simulation will calculate the volume and cost of either residual oil or purchased gas required.

Heavy distillates. Various grades of heavy distillates are blended using a linear program. The blends can be optimized through use of proper values for individual stocks or the blends can be directed to use stocks in an order of preference.

The volume and characteristics of the individual stocks in the blends, the volume and characteristics of the final blends, and the desired volumes and specifications are shown on the final printout. Some of these characteristics are gravity, sulfur, distillation points, pour, viscosity, and cetane number.

Motor fuel. These blends are also made using a linear program. Approximately 14 individual stocks and 6 blends of motor fuel can be handled. The volume, per cent in blend, and characteristics of the individual gasoline streams, the volume and characteristics of the final blends, the desired volume, and specifications are shown on the final printout.

Some of the characteristics are vapor pressure, distillation points; slope of the distillation curve; motor and research octane numbers with 1 cc. of TEL, with 3 cc. of TEL, and the required amount of TEL for specification octane numbers.

The routine includes a volatility control which interlocks the vapor pressure and the slope of the distillation. The methods for blending vapor pressures and distillation points were developed by Phillips and the predictions are as accurate as the test methods.

The linear program will produce blends of motor fuel that will meet all specifications. After specifications are met the objective is to minimize the total cost of TEL used in all blends. The linear program attempts to accomplish this by using various factors which are related to the cost of octane numbers.

Many methods of minimizing the total use of TEL have been investigated and a few were found which will perform satisfactorily most of the time. However, we do not know of a system which will minimize the total use of TEL under all conditions. If the operation under consideration is similar to the one which was used as a basis for determining the factors to use in the linear program, then the answers obtained have a good chance of being correct.

Weight balance. An over-all weight balance is made between the raw products charged and the final products yielded, even though all units are individually balanced. We find the weight-loss figure very useful in checking the final results. Computers are not infallible and we are not willing to accept blindly the results of a calculation.

Costs. The manufacturing expense is printed for each unit by classes and in total. Classes of expense include operating labor, repair labor, supervision, repair material, supplies, catalyst, fuel, water, electricity, steam, air, shops, laboratory, etc.

Supplemental information is also printed. Some of these are fuel supplied by sources, total cost and unit cost; gallons of water supplied, total cost and unit cost, electricity supplied by source, either produced or purchased, the total cost of each and the unit cost of each. Total steam required is shown as well as total cost and unit cost. Factors can be inserted on the data sheets which are used to correct labor and material costs for any change in the base rate for these two items.

Individual crude oils and other raw charge stocks are shown and priced to obtain total cost. All products are priced and gross income obtained. The gross income is adjusted for raw-material cost, operating expense, TEL, overhead charges, and depreciation to obtain a margin before income tax. The cost of finished products is calculated by either or both of two methods.

How it looks. The final printout lists input and output products by name, the cost or sales price in dollars per gallon and per barrel, the volume of each product, the cost or income from each product in dollars per day and dollars per barrel of input volume, the volume and weight per cent of each product, the cost of the finished product, the upgrade of finished products over raw products, a summary of operating expenses, and the margin for profit.

The simulation performs all of the calculations in units per day. It is desirable in many instances to have units per month for the finished products and the various expense items. After the problem is complete the simulation prints out volumes and expenses for 28, 30, and 31 days so that figures are available for any month.

The simulation program is static for only short periods. Changes are necessary to keep up with changes in processing equipment. New data are constantly being obtained and correlations improved. New uses are being found for the simulation which requires expanding the program.

Approximately 8 to 12 data sheets are required to run a complete problem using the simulation program. Each line on the data sheet represents one IBM card.

To identify each card, a number has been assigned to it and placed in the last block on the right-hand side of the line. Many of the data blocks contain preprinted entries when this particular entry remains relatively constant. These entries may be changed by marking through the given number and writing in the desired number.

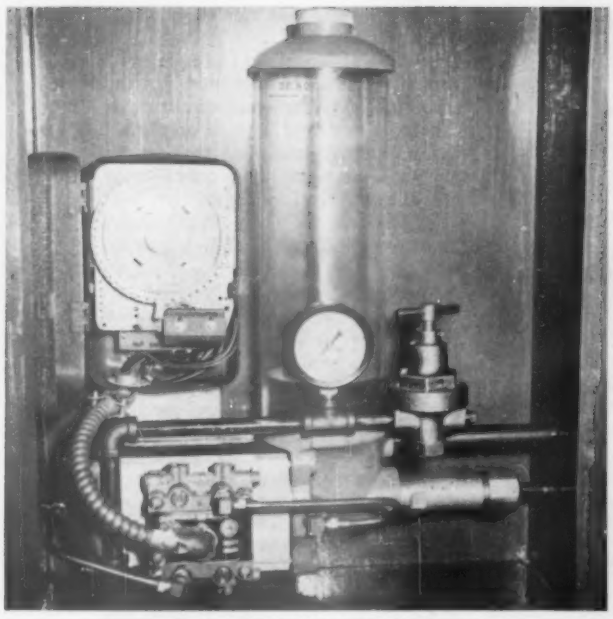
We prefer to print some items on the data sheets rather than bury them in the routine, as it is easier to make an occasional change in this manner. It is not necessary to fill in a complete set of data sheets for each case. One complete set of data sheets plus a sheet indicating which cards are to be changed will give a complete set of cases for a problem.

A data book has been issued for each simulation. The data book includes a description of the simulation, instructions for filling each data sheet, the equations used for each of the operating units, specifications for products, normal demand volumes for products, and prices for finished and raw products. The data book has been a big help in obtaining comparable results from different problem originators.

One of the benefits of simulating refinery operations is additional knowledge on each phase of operations. A large part of the time spent in preparing the simulation was on improving correlations and unit operating factors.

Speed in obtaining answers is not as important as getting the right answer. Insofar as speed is concerned the IBM 709 is a very fast computer. The time required for the refinery-simulation program varies from 1 to 3 minutes, depending upon the refinery.

The simulations are the results of approximately 7 man-years of combined efforts of a large number of people. We believe this effort will be returned many times from well-planned, efficient operations.



AUTOMATIC LUBRICATION EQUIPMENT in its case. Electric clock at upper left activates an air valve at preset time intervals. Length and frequency of these intervals can be controlled. Air pressure then injects grease into mud-pump stuffing boxes.

FREQUENT INJECTIONS of small amount of grease keep lubricant in the packing and mud out. Flexible hose shown here carries lubricant from injector to stuffing box. Conventional packing may be used with the automatic equipment.

Stuffing-box lubricator saves mud pumps, rods, and packers

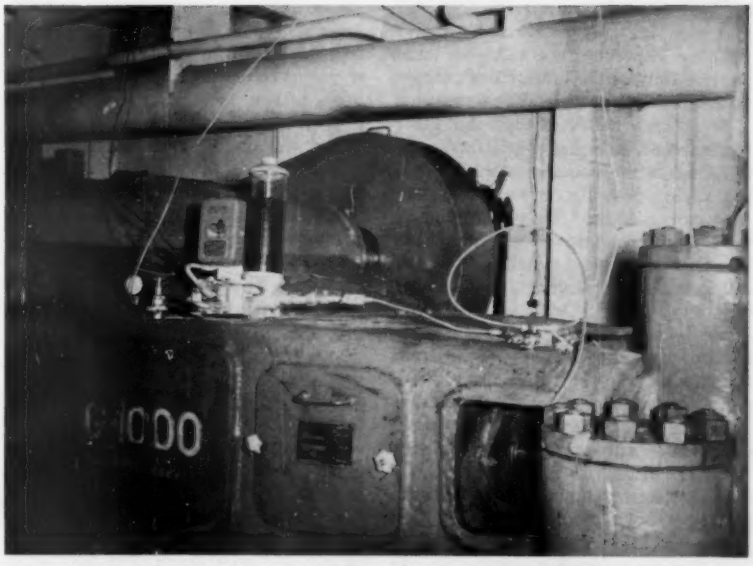
BY ED McGHEE
Drilling Editor

DRILLING CONTRACTORS can cut the cost of operating their mud pumps if they install automatic lubricators on the stuffing boxes.

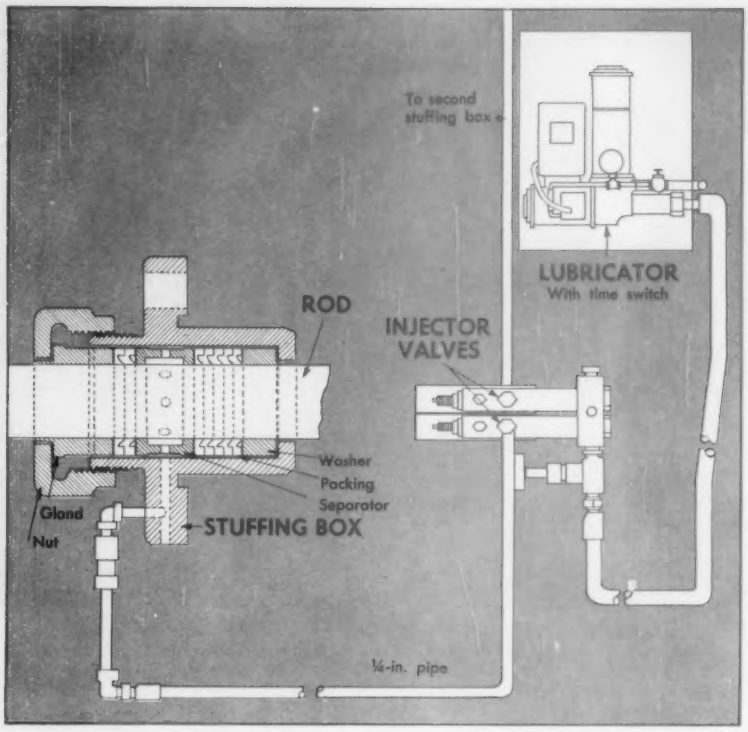
Automatic lubrication lengthens the life of both pump rods and rod packing.

More than 20 lubricators have already been installed on rig pumps; some have operated for 3 years. They have proved reliable, trouble-free, and much more effective than usual hand methods of stuffing-box lubrication. On one test of several week's duration, rod and packing life was extended more than 20% by use of the lubricator. All firms contacted which have lubricator-equipped pumps say they feel certain they get longer service out of rods and packing because of these units.

Pump men agree that better lubrication by any means is certain to make these vital pump parts run longer; the



TEST INSTALLATION of the automatic lubricator was made on this 1,000-hp. pump; for permanent mounting, the injector and grease reservoir are placed in a housing which will protect them from bumps and water.



BOTH STUFFING BOXES receive an equal volume of grease; each injector valve meters out the same amount of grease. The electric time switch can be set so that the boxes get plenty of lubrication without grease being squeezed out.

automatic lubricators appear the surest and cheapest way to get this better lubrication.

The lubricators described here are of the type installed by National Supply Co. on a number of recently sold pumps. National does not manufacture the lubricators but has installed them to help several customers whose special pumping problems made rod-and-packing expense even higher than usual. Many of the lubricator-equipped pumps have been shipped overseas.

It is also believed that the lubricator would be equally as effective on old pumps as it is on new. Nor, is the saving possible only in high-pressure work. Indeed, many believe that very few rig pumps would not show enough saving to quickly pay out automatic lubrication to the stuffing box.

Time cycled. Grease is not injected into the stuffing box continuously. Instead, small amounts of grease are squeezed in at intervals, a few minutes apart and only when the pump is actually running.

This time cycling is regulated by an electric clock run off the rig's light plant. The clock turns a wheel much like that on a gas-life intermitter. As the wheel rotates, it makes and breaks electric contact at intervals (by means of pegs placed in holes about the wheel's rim). When electric contact is made, it causes the grease injector to work.

Number of contacts (pegs) on the wheel can be changed quickly and easily to work the injector at any interval varying from several times per minute to an hour or longer. The proper interval is one in which plenty of grease is supplied, but the packing it not over pressured.

In effect, all the clock does is trigger a solenoid on an air valve. Then, the air does the work of injecting grease into the stuffing box. The amount and pressure of air needed for this job is low, a small fraction of the capacity of the rig's air system. However, construction of the injector is such that only 100 psi. of air pressure is enough to force grease easily into the stuffing box of a pump running against 3,000-psi. mud pressure.

It has been customary to tie the air line of the injector to the air supply on the pump clutch. Then, when the pump is disengaged, the injector gets no air and doesn't work.

Actually, two injectors are used; one for each stuffing box on the conventional duplex pump. This way, each stuffing box gets the same amount of grease regardless, even if one set of packing is worn much more than the other.

Not only can the time between grease injections be regulated, but the amount of grease injected on each shot can be varied too. This is controlled by an external "metering nut" on the injectors. Flexible hoses carry the grease to the stuffing boxes.

Time clock, air valve, and injectors have been put together into a protective box that shields the equipment from accidental blows or wettings. Included into the box are a small reservoir for grease and a 60-watt light bulb which provides enough heat to keep the grease warm and pumpable in cool weather. In addition, the light shows when the unit is operating.

Use conventional packing. National recommends that ring packing be used with the automatic lubricator; this type makes best use of the lubricant. Chevron packing, however, can be used without complications.

Very likely, National believes, the automatic lubrication would get best results if one or two packing rings on the mud end were turned around from usual practice. That is, they would seal against the grease instead of against the mud. This arrangement doesn't appear to be crucial, however, and it would probably be difficult to train rig crews to make the change.

National recommends the lightest available weight of high-temperature waterproof grease for use with the lubricator. Such grease, the company says, should contain 10 to 20% graphite.

Acknowledgment

Credit is due A. L. (Mac) Harrington and Bob Henderson, both of National Supply Co., Houston, and co-developers of this type of lubricator system, for help in the preparation of this article.

Watch for these articles next week

1. **Can We Use Two Recovery Mechanisms in Same Reservoir?** West Bisti unit engineers plan to water-flood without interfering with adjacent miscible flood in same continuous reservoir.

2. **Instrumentation 3 Years Later at Tidewater Delaware City.** Scanning and logging systems and contract instrument-maintenance program have been successful.

How Atlantic operates the SLAUGHTER FLOOD

• The world's most closely watched injection project is using LPG, then gas, then water to gain greater oil recovery. The process, still in the experimental stage, is far from the goal of complete recovery, but with sound engineering and careful planning it can result in the production of large quantities of "unrecoverable" oil.

BY ROGER E. SESSIONS
Atlantic Refining Co.,
Midland, Tex.

ATLANTIC'S operation, another step in industry's effort to obtain maximum oil recovery, is being conducted on its H. T. Boyd lease in Slaughter field. It combines the desirable features of miscible displacement with those of water flooding. Under certain conditions LPG is soluble or "miscible" in both oil and gas. Thus, the LPG acts as a solvent in the reservoir rock, and it washes out almost 100% of the contacted oil. The water and gas used in a normal waterflood or gas-injection project are not soluble in the oil and will not wash the reservoir rock clean. Propane, gas, and water are being used to flood this reservoir. The quantity and rate of injection of each material was specifically designed for this operation.

Indications are that the expected recovery (62% of the oil originally in place) will be achieved. Also, the project is furnishing valuable knowledge concerning miscible-type displacement. Results to date were not all anticipated, or in other words, could not be predicted by normal engineering methods. Through close engineering control, however, it has been possible to adjust the operation to meet changing conditions.

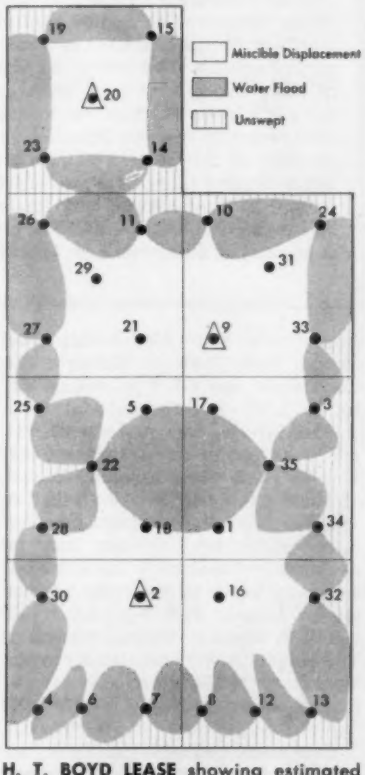
In brief, the desired operating pressure has been achieved; a general oil-bank buildup is indicated; increasing oil productivity and lower gas-oil ratios have been observed; and only a small percentage of the injected material has been produced. It has been necessary to overinject by nearly 3 million barrels in order to achieve the desired operating pressure. Injected and produced volumes are shown in Table 1.

Field and Lease Data

Slaughter field (San Andres pay) is located on the northwestern shelf of the Periman basin in Cochran, Hockley, and Terry counties.

The San Andres pay is a crystalline dolomitic lime found at a depth of about 5,000 ft. The structure is a gentle monocline dipping to the south. Oil accumulation is due to local porosity and permeability development. Logs and core data indicate a certain amount of zoning.

The H. T. Boyd lease is located in the west-central portion of the field. It covers 1,247.4 acres and has 35 wells. This is a relatively large lease, but it is only a small portion of the total field which covers some 87,200 acres and has 2,583 producing wells.



H. T. BOYD LEASE showing estimated sweepout pattern. White area will be swept miscibly and the gray area will be produced by water flood alone. Fig. 1.

Reservoir data are as follows:

Porosity, %	2-25
Porosity average, %	12.2
Permeability, md.	1-100
Permeability average, md.	10
Oil gravity, ° API	29-32
Gas gravity	0.86
Connate water, %	11
Initial pressure, psia.	1710
Bubble-point pressure, psia.	1710
Initial GOR, cu. ft. per bbl.	465

Engineering Analysis

Before starting this operation, the past performance was studied. This indicated that the large quantity of oil already produced represented only 15% of the oil originally in place and only an additional 5% could be expected by primary means. The pressure had declined to an average of 640 psia. and the average gas-oil ratio was 4,600 cu. ft. per barrel.

In an effort to select an efficient means of secondary recovery, consideration was given to water flooding and to miscible-phase displacement. Engineering studies showed a conventional water flood would result in the ultimate recovery of 54% of the oil originally in place.

The propane-gas-water injection process required raising the reservoir pressure to miscibility pressure (about 1,300 psia.). This higher pressure requires the process be confined to the central portion of the lease in order to prevent migration of oil. For this reason, the program was designed to sweep only 35-40% of the area miscibly. Fig. 1 shows the estimated areas to be swept miscibly and by water. Calculations indicate the designed propane-gas-water injection process will result in an ultimate recovery of 62% of the oil originally in place.

Some zoning. Past studies of poro-

sity and permeability development had indicated zoning in parts of the reservoir. This was thought to have little effect on primary performance, and variations in productivity were attributed to differences in pay thickness. Core-analysis data on the lease was limited since only two wells had been cored. Individual measurements on core plugs showed wide variations in porosity and permeability. Average values of permeability and estimated net pay were first used to calculate the required injection rates using seven injection wells.

A further check was made on the permeability-thickness product by analyzing bottom-hole-pressure buildup curves taken on the lease. The curves were difficult to analyze since the reservoir fluid is highly compressible, but they did show a considerably higher value of permeability-thickness product than had been originally used. Calculations based on these higher values showed the rate required to maintain miscibility was over twice that originally anticipated. The number of injection wells was reduced to three to compensate for this difference in injectivity.

What's Been Done

In October 1957 a hearing was held before the Texas Railroad Commission, to obtain permission to carry out the project. Permission was granted to inject propane-gas-water into the San Andres formation through three injection wells (No. 2, 9, and 20). The transfer of allowable from the three injection wells was approved, and up to 100% of the unpenalized allowable could be transferred to any well to improve the operating efficiency. The lease could be operated under a net gas-oil ratio of 2,000/1 as long as reservoir withdrawals were balanced by injection.

Timing important. Since the lease is located about 4 miles from the Slaughter gasoline plant, a seasonal supply of propane and a source of residue gas was readily available. The timing of the propane injection was important since the availability and price of the propane is affected by the season. A 4-in. pipeline was laid from the plant to the lease to supply propane and injection gas. Additional volumes of propane were trucked to the lease.

The propane was supplied by various plants scattered over a radius of 150 miles and required the delivery of 35 truckloads per day. This means that a truck was arriving every 40 minutes day and night.

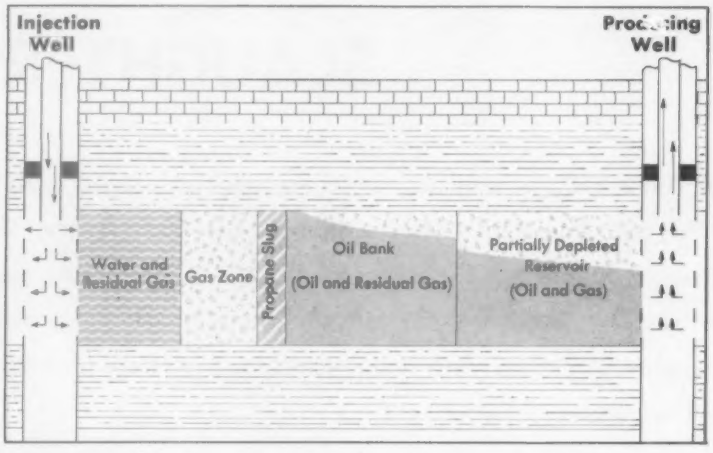
An adequate supply of water is available from the Santa Rosa formation underlying the lease. A water-supply well was drilled, near the central tank battery, through the Santa Rosa and 8-5/8-in. casing was set at 2,285 ft. The interval from 2,035-2,110 ft. was perforated, and a 5-½-in. casing pump was installed. The well has been tested at a rate of 8,000 bbl. water per day which is adequate for the present injection rates. Additional capacity can be obtained by perforating more section and installing a larger pump. Water salinity is only 25,000 p.p.m. NaCl, and it is injected without treatment. The supply tank is kept under a gas blanket to lessen corrosion on surface equipment.

Equipment consolidated. Tank batteries on the lease were consolidated into one central battery, and flow lines from the wells lead into two centrally located manifolds. Included is equipment to automatically control production and test individual wells. Two wells can be tested simultaneously. In addition, portable testers are used to take the frequent production tests required in following the progress of the flood. From the manifolds, the well streams are sent to a central treating and storage area.

Also located in this central area are the water-supply well, water-injection pumps, and the gas compressors. The water pumps have a capacity of 7,300 bbl. per day, and the two 400-hp gas compressors are capable of supplying up to 7 M.M.c.f.d.

Propane was injected by a contractor using specialized equipment which was removed on completion of the job.

The three injection wells are equipped with individual manifolds and flow lines. These are capable of



THIS IS HOW the propane slug will look in the reservoir, injected propane is followed by gas then water. The LPG miscibly displaces the oil, the gas miscibly displaces the propane, and the water displaces the gas.

Why Atlantic chose to inject LPG, then gas, then water

LABORATORY TESTING has shown LPG will efficiently displace 100% of the oil contacted in a sand packed column. This led to the idea of using this process in a reservoir, but LPG is too expensive to replace total reservoir voidage. Practical application of this process requires the use of a small slug of LPG followed by gas. LPG is miscible with the oil and sweeps it out efficiently. The gas is injected at a pressure high enough to miscibly displace the LPG.

This process will effectively displace the oil contacted, but the high LPG-gas mobility results in a poor sweep efficiency. The over-all efficiency is about like that of a water flood. This can be improved by combining the high unit displacement efficiency of the gas-driven LPG slug with the good sweep efficiency water. This is accomplished by following the gas injection with water.

The water pushes the gas and LPG into a larger part of the reservoir, and as a result a greater portion of the reservoir is swept miscibly. Close control of the volume of gas is required since the gas serves as a buffer zone and prevents LPG from being left as a residual phase. A schematic representation of the combined process is shown in the cut.

This process uses an injected band of intermediates to achieve miscibility rather than creating such a band in the reservoir as is done in the high-pressure gas drive and the condensing gas drive. This gives the LPG slug process more adaptability since it can be used in reservoirs with lower pressure and shallower depths. Also, the composition of the injected gas and the reservoir fluid is not as critical and smaller volumes of gas are required.

A project of this type requires careful engineering to maintain an LPG slug, maintain a buffer zone of gas, and to insure the volumes are large enough to flood the desired portion of the reservoir. On the other hand, the slugs must be small enough to minimize the initial investment and operating expense.

Careful consideration must be given to the advantages and disadvantages of this type of process as compared with other feasible secondary-recovery projects. Some of the factors to be compared are pressure requirements, crude characteristics, character of the producing formation, availability of injection fluids, expected oil rate, operating expense, and initial investment.

The gain in recovery over primary must be evaluated and considered for each type of secondary-recovery project.

How should wells respond? The progress and efficiency of the miscible flood can be evaluated by analyzing the behavior of individual wells. The ideal behavior of a producing well would be to have a pressure increase, a large oil-capacity increase, and a decrease in the gas-oil ratio to near the solution volume. After the oil bank is produced, there should be an increase in propane concentration followed by a large increase in gas-oil ratio. When the gas-oil ratio increases on a well, it is often desirable that it be shut in for the remainder of the miscible portion of the project. This prevents voidage of the gas slug.

It is possible for other types of behavior to occur. If the injection rate and pressure are not sufficient to create an oil bank, the propane will be dissipated by absorption in the oil, and it is unlikely an increase in propane concentration will be noted at the producing well. If the propane-gas interface pressure is below the miscible pressure, the propane slug will be left in the gas zone as a residual phase.

If stratification exists, the process will take place in each stratum but at different rates so that the oil bank will arrive at the producing wells in stages. The effect of stratification acts to increase the gas and propane requirements necessary to obtain the designed ultimate recovery.

handling and metering either propane, gas, or water as required.

No new wells drilled. Wells No. 2, 9, and 20 were converted to injection wells by running a permanent-type packer in the bottom of the 5-½-in. casing and equipping the wells with 2-½-in. tubing. Fluid is being injected into the open-hole interval.

A radioactive injectivity profile test was taken on each of the injection wells. These tests showed no communication problems, though indicating a variable but not severe degree of stratification.

First propane. Propane injection began in all three injection wells on May 9, 1958. By July 3, 1958, the required 255,416 stock-tank barrels of propane had been injected. Average injection rate was 4,360 bbl. per day at pressures ranging from 120 to 1,200 psi.

Then gas. Gas injection was started in all three injection wells on July 3, 1958. At a lease injection rate of 4.8 M.M.c.f.d., the average surface injection pressure ranged from 1,300 to 1,350 psi. This rate of injection was too low to give the desired safety factor in maintaining a reservoir pressure of 1,300 psi. The need for a higher injection rate is best explained by assuming that in these old shotholes larger well bores exist. The total lease rate was increased to over 6 M.M.c.f.d. This raised the average surface injection pressure to between 1,400 and 1,650 psi. A total of 2.6 M.M.c.f. of gas was injected.

Followed by water. The total requirement of gas for the No. 20 injection well had been injected by January 22, 1959, and water injection was started immediately. Injection wast started in well No. 2 on July 1, 1959, and in well No. 9 on July 29, 1959. Water and gas are being injected on a cyclic basis in these two wells. The injection of gas and water was undertaken to reduce the average mobility of the injection stream. This lower mobility reduces the amount of the injected stream entering the higher permeable layer relative to that entering the lower permeable section. In establishing a region of gas and water flow, these materials are being injected on a 56-day cycle.

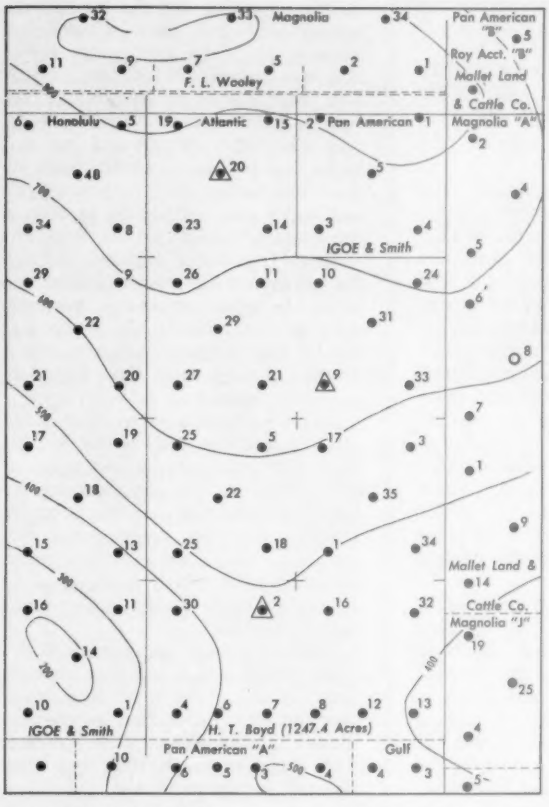
An attempt was made to inject water and gas simultaneously in the No. 20 well. The well took gas and water in alternate slugs. The simultaneous injection method failed as the injection facilities were not designed for this operation. The alternate slug method was then used and it is expected to achieve the same results as the simultaneous method.

Table 1 gives a breakdown of the rates, pressures, and volumes for each injection well. The total lease injection and lease production in reservoir barrels is also given. This indicates 2.25 times as much fluid has been injected as was produced.

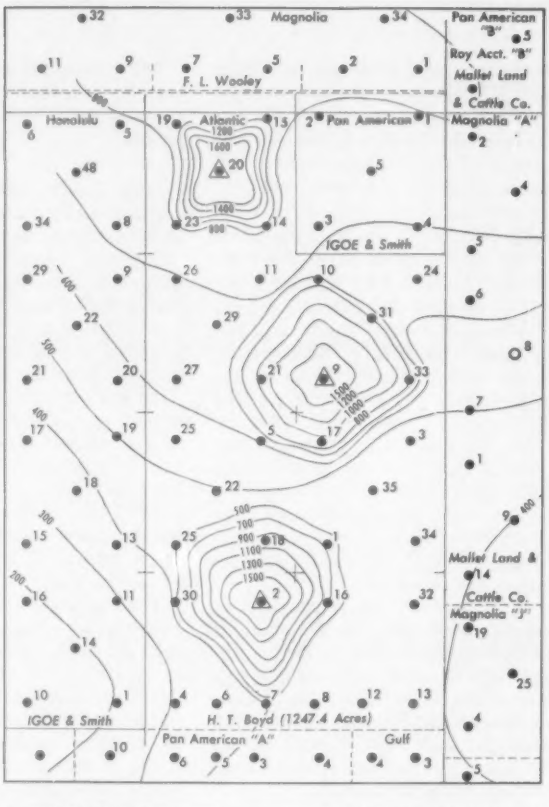
Pressure increased. The overinjection of 2.25 times the reservoir voidage has increased the pressure on the lease. Fig. 2 is an isobaric map showing the 15-day shut-in pressure points as of February 1958. Fig. 3 is an isobaric map showing the 15-day shut-in pressure points as of February 1959. Extrapolated 15-day pressure points are shown on our lease in order to compare the lease pressure with the offsetting lease pressures. Also shown is the calculated bottom-hole pressure of the injection wells. Fig. 4 is an isobaric map showing the net change between these two periods. This figure indicates an increase of as much as 1,000 psi. over much of the lease while other sections show a pressure drop, or no change at all.

Buildup-curve analysis indicates the 72-hour shut-in pressures are still far from final buildup pressure. Calculations show that over 1,000 hours of buildup time is required to obtain a stabilized pressure. Since it is impractical to shut in wells for this period, the stabilized reservoir pressure at the radius of drainage is calculated from buildup curves. Likewise, the pressure at the fluid front has been calculated from drawdown pressure surveys taken on the injection wells.

MER increased. In July 1959 a sec-



BOTTOM-HOLE-PRESSURE map as of February 1958. Fig. 2.



BOTTOM-HOLE-PRESSURE map as of February 1959. Fig. 3.

ond hearing was held before the commission to present the results to date. It was pointed out that overinjection had resulted in a general increase pressure on the lease. Miscible displacement was occurring in the reservoir. Because of the pressure build-up on the lease and the formation of an oil bank, higher rates were required to prevent migration of oil. Also, maximum use had been made of the flexibility of operation given in the original order. The commission granted a lease allowable of 1,400 bbl. oil per calendar day.

Periodic tests. Control of the project has required extensive testing and care-

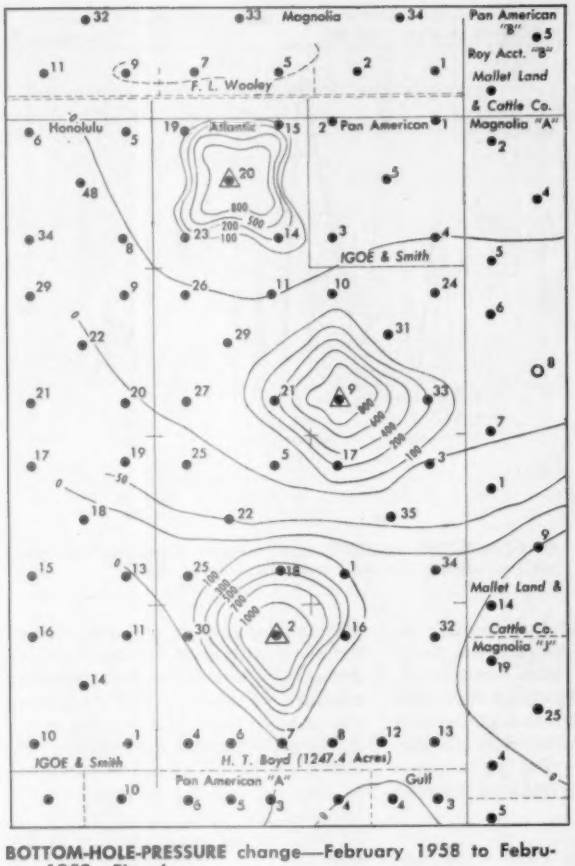
TABLE 1—VOLUMES INJECTED AND PRODUCED DURING THE PERIOD OF MAY 9, 1958, TO AUGUST 1, 1959

	Injection				Reservoir barrels
	Well 2	Well 9	Well 20	Lease total	
Propane, stock-tank barrels	99,760	118,027	37,629	255,416	255,416
Average daily rate, stock-tank bbl. per day	1,850	2,180	700		
Average injection pressure, psi.	950	1,200	140		
Gas, M.c.f.	841,172	875,126	385,123	2,101,421	3,745,848
Average daily rate, M.c.f. per day	2,320	2,240	1,900		
Average injection pressure, psi.	1,530	1,485	1,385		
Water, stock-tank barrels	100,225	13,393	630,279	743,897	743,897
Average daily rate, bbl. per day	3,233	4,464	3,300		
Average injection pressure, psi.	1,750	1,400	1,535		
Total reservoir barrels injected into lease					4,745,161

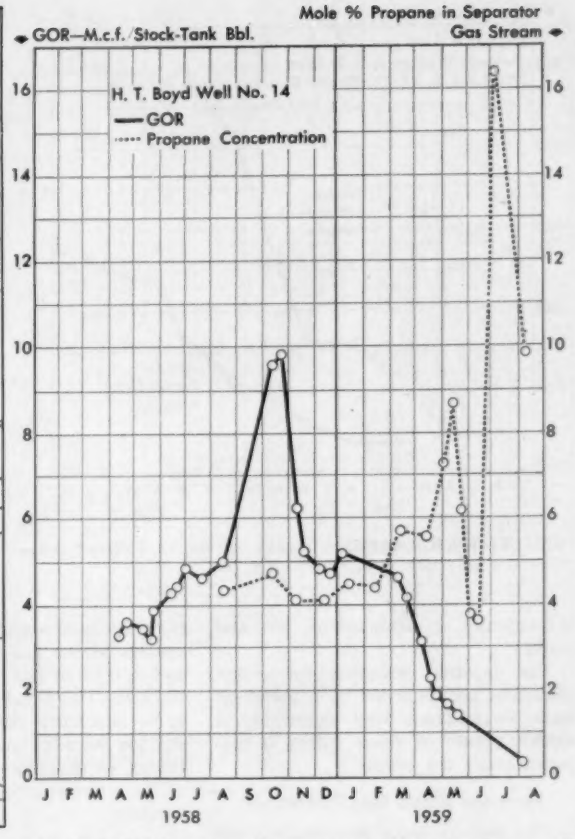
LEASE PRODUCTION

Oil, stock-tank barrels	Gas, M.c.f.	Water, stock-tank barrels	Reservoir barrels
235,298	1,110,636	4,788	2,106,330

$$\frac{\text{Reservoir Barrels Injected}}{\text{Reservoir Barrels Produced}} = \frac{4,745,161}{2,106,330} = 2.25$$



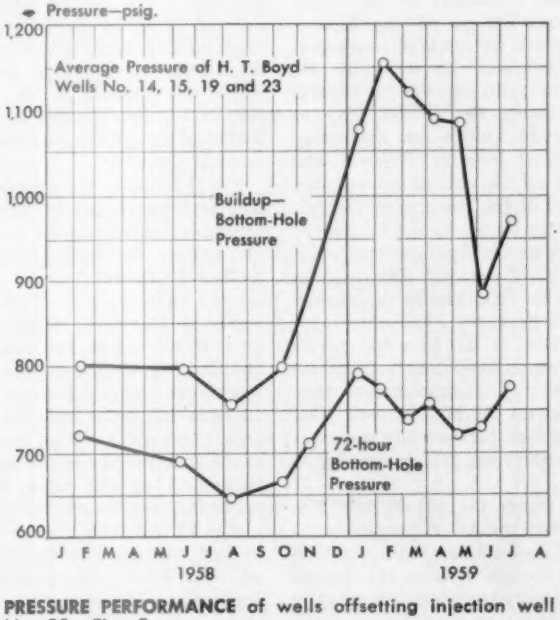
BOTTOM-HOLE-PRESSURE change—February 1958 to February 1959. Fig. 4.


Mole % Propane in Separator Gas Stream
GOR—M.c.f./Stock-Tank Bbl.
H. T. Boyd Well No. 14
GOR
Propane Concentration
J F M A M J J A S O N D J F M A M J J A
1958
1959

GAS-OIL-RATIO history and propane concentration for a well offsetting injection well No. 20. Fig. 6.

ful scheduling of work. This has made it possible to determine what is happening and how to make adjustments for changing conditions.

At the start of the project, productivity-index surveys were taken monthly on all offsets to injection wells. But a severe foaming problem made sonolog shots, taken while pumping or shortly after shut in, unreliable. Currently, a monthly static bottom-hole-pressure survey is being made on these wells by taking sonolog pressures after 24, 48, 72, and 96 hours of buildup. Each well is shut in after producing at a stabilized rate for 5 days. The buildup curves are used to calculate the stabilized reservoir pressure at the radius of drainage.

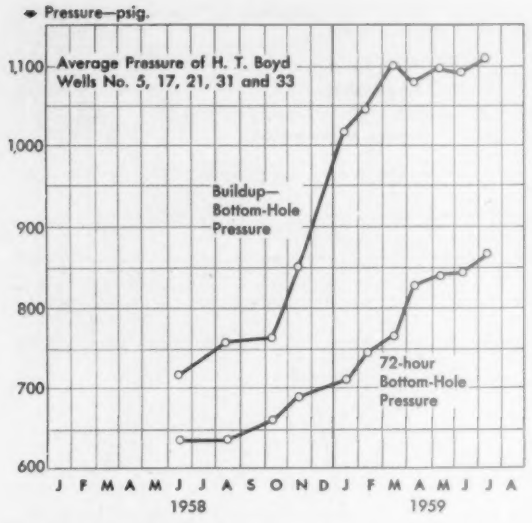

Pressure—psig.
Average Pressure of H. T. Boyd Wells No. 14, 15, 19 and 23
Buildup—Bottom-Hole Pressure
72-hour Bottom-Hole Pressure
J F M A M J J A S O N D J F M A M J J A
1958
1959

PRESSURE PERFORMANCE of wells offsetting injection well No. 20. Fig. 5.

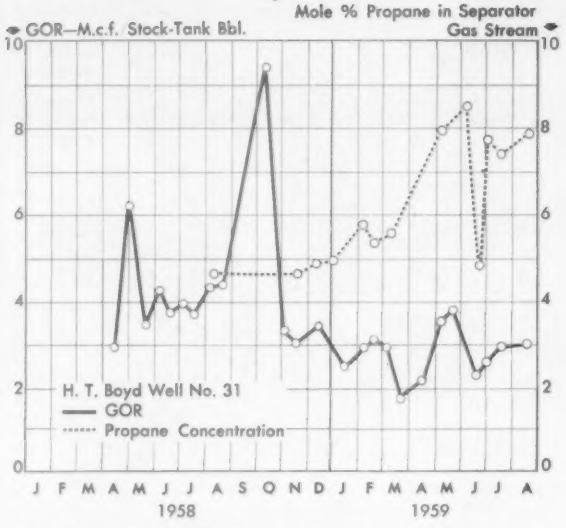
Drawdown pressure surveys are taken periodically on the injection wells. This pressure is used to calculate the pressure at the flood front, and insures that the surface injection pressure is sufficient to maintain miscibility.

Monthly gas samples are taken on each well and are analyzed by a gas chromatograph. The molecular concentration of propane is used to trace the progress of the propane slug.

Production tests are taken monthly after each well has produced for 4 to 5 days at a constant rate. These tests are used to determine the oil capacity, the gas-oil ratio, and in tracing the progress of the flood. Also, a record is kept of the hours each well produces during the month in addition to the normal record of



PRESSURE PERFORMANCE of wells on the H. T. Boyd lease offsetting injection well No. 9. Fig. 7.



GAS-OIL RATIO HISTORY and propane concentration for a well offsetting injection well No. 9. Fig. 8.

the volumes of produced oil, gas, and water.

The injected volumes, rates, and pressures are recorded by a meter on each injection well manifold. A weekly report of these values is prepared from the charts.

How the Flood Has Performed

The over-all lease performance can best be summarized by studying the behavior of typical wells.

Northern area. Fig. 5 shows the average bottom-hole pressure of the wells offsetting the northern injection well No. 20. The two lines represent the reservoir pressure at 72 hours and the calculated final buildup pressure at the radius of drainage. Overinjection has raised the pressure to a point high enough to maintain miscibility at the front.

Individual wells have shown their own particular type of performance. Fig. 6 shows the gas-oil-ratio history and the results of propane concentration measurements on well No. 14. The gas-oil ratio increased steadily during the period May to October 1958. After this time, the decreasing gas-oil ratio indicates the presence of the oil bank which is also responsible for the increase in productivity. At the start of the project, the capacity of this well was 52 bbl. of oil per day. In December 1958 the capacity had increased to 82 bbl. of oil per day, and in August 1959 to 181.

The propane concentration remained in the normal background range of 4 to 5 mole per cent until March 1959 when it increased. This increase is caused by two factors: (1) propane concentration normally increases as the gas-oil ratio decreases, and (2) there has been some breakthrough. This breakthrough is thought to be in a small volume high-capacity stringer since the gas-oil ratio has continued to decrease. The performance of the other wells in this area has been similar.

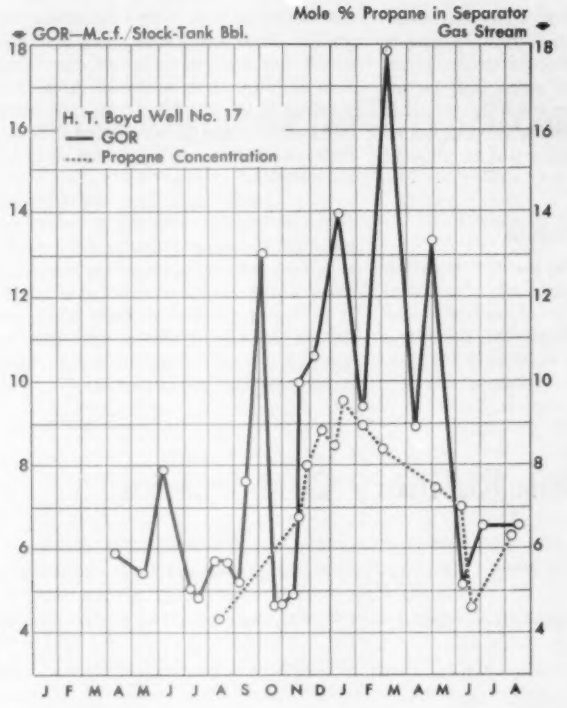
Central area. Fig. 7 shows the average bottom-hole pressure of the wells offsetting the center injection well No. 9. The average reservoir pressure at 72 hours and the calculated final buildup pressure at the radius of drainage are shown. Pressure is sufficient to maintain miscibility at the front. Fig. 8 shows the gas-oil-ratio history and the results of propane concentration measurements on well No. 31. The gas-oil ratio showed a general increase during the period May to October 1958 and began decreasing as the oil-bank built up. This well had a capacity of 54 bbl. of oil per day at the start of the project. In December 1958 the capacity was 62 bbl. of oil per day and in August 1959 it was 145 bbl. of oil per day. The propane concentration remained in the normal range until February 1959 when it increased. Also, at this time the gas-oil ratio increased indicating a more severe degree of stratification than existed around the No. 20 well. This indicates a high permeability zone was swept miscibly, but it is continuing to take gas.

Fig. 9 shows the gas-oil-ratio history and the results of propane concentration measurements taken on well No. 17. Though erratic, the gas-oil ratio has generally increased until early in 1959. The high gas-oil ratio along with the increase in propane concentration is attributed to the breakthrough of a series of high-permeability stringers. In March 1959 production was reduced to 10 bbl. per day to decrease gas voidage in the reservoir. Recently the gas-oil ratio has continued to decrease and the oil capacity has increased indicating the advance of an oil bank in the major portion of the reservoir. The performance of wells Nos. 17 and 31 is typical of others in the area.

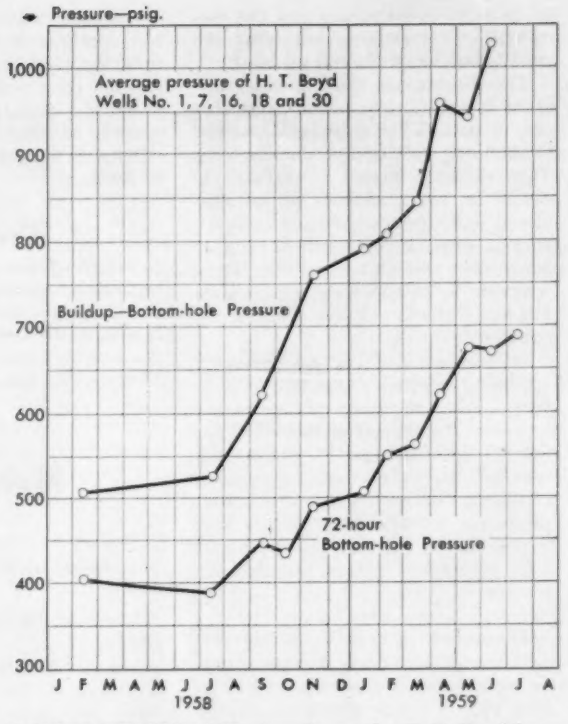
Southern area. Fig. 10 shows the average bottom-hole pressure of the wells offsetting the southern injection well No. 2. The average reservoir pressure at 72 hours and the calculated final buildup bottom-hole pressure at the radius of drainage are shown. While this pressure is not as high as that in the other areas, it should be sufficient to support miscible displacement at the front.

Fig. 11 shows the gas-oil-ratio history and the results of propane concentration measurements on well No. 18. During the period May to September 1958 the gas-oil ratio decreased, showing the effect of an oil bank. In December 1958 there was an increase in propane concentration indicating breakthrough of propane in a high-permeability stringer. The gas-oil ratio increased and has remained high. Advance of the oil bank in most of the formation, and the alternate injection of gas and water, should improve the performance in the future.

Fig. 12 shows the producing history of well No. 16. The decrease in gas-oil ratio during the period May to September 1958 indicates an oil-bank buildup. During the period September

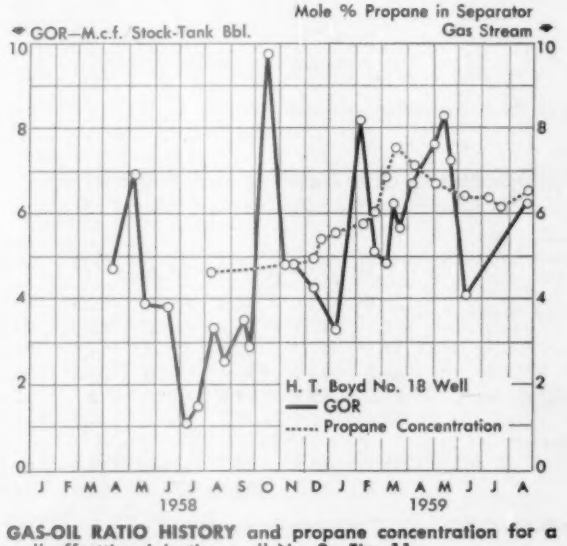

Mole % Propane in Separator Gas Stream
GOR—M.c.f./Stock-Tank Bbl.
H. T. Boyd Well No. 17
GOR
Propane Concentration
J F M A M J J A S O N D J F M A M J J A

GAS-OIL RATIO history and propane concentration for a well offsetting injection well No. 9. Fig. 9.

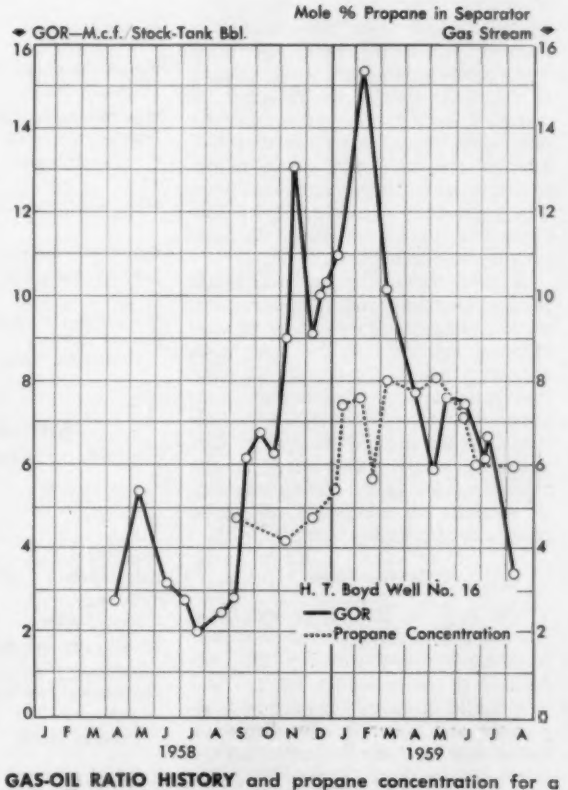


PRESSURE PERFORMANCE of wells on the H. T. Boyd lease offsetting injection well No. 2. Fig. 10.

to December 1958 there was a large increase in gas-oil ratio. This came before the increase in propane concentration in January 1959. This indicates immiscible displacement through a small stringer followed by miscible displacement in another stringer. Although a good pressure increase was obtained in this well, it is possible the pressure was not raised fast enough to obtain miscible displacement in all strata. Currently the


Mole % Propane in Separator Gas Stream
GOR—M.c.f. Stock-Tank Bbl.
H. T. Boyd No. 18 Well
GOR
Propane Concentration
J F M A M J J A S O N D J F M A M J J A
1958
1959

GAS-OIL RATIO HISTORY and propane concentration for a well offsetting injection well No. 2. Fig. 11.


Mole % Propane in Separator Gas Stream
GOR—M.c.f./Stock-Tank Bbl.
H. T. Boyd Well No. 16
GOR
Propane Concentration
J F M A M J J A S O N D J F M A M J J A
1958
1959

GAS-OIL RATIO HISTORY and propane concentration for a well offsetting injection well No. 2. Fig. 12.

oil capacity is increasing and the gas-oil ratio is decreasing indicating the advance of an additional oil bank.

The illustrations show a wide variation in gas-oil-ratio history, probably due in part to the problems involved in obtaining stabilized production tests. This variation makes it difficult to obtain an exact analysis of an individual well's performance. All the examples show a high gas-oil ratio in September and October 1958. There is reason to believe these are in error due to installation of new gas-metering equipment on the lease.

As mentioned earlier, gas and water are being injected alternately in wells Nos. 2 and 9 to obtain a better mobility ratio. The success of this effort has not yet been determined. Present figures indicate only a small percentage of injected gas and propane has been produced. Most of the injected fluid is still in the reservoir at a pressure high enough to obtain miscible displacement.

Discussion. In general, the northern area has performed as expected, indicating a fairly homogeneous reservoir with only a minor degree of stratification. The central and southern edge of the lease has shown a greater degree of stratification.

Miscible displacement in individual strata is shown by early breakthrough of propane followed by an increase in gas production. This breakthrough is probably caused by small individual strata while an oil bank is developing in the major part of the reservoir. A complete study is being made to determine what effect this stratification will have on the entire project. In the southern area, the performance shows that pressure was not raised fast enough to support miscibility in some of the individual strata.

A good increase in individual well productivity indicates a general oil-bank buildup in all areas. The greatest increase has been in the four wells offsetting injection well No. 20. The total lease capacity has increased from about 910 to 1,800 bbl. of oil per day since the start of the project. The current capacity is influenced by the injection rates, and it should continue to increase as additional oil banks reach the producing wells.

Future Plans

The miscible portion of the flood has been completed in the area surrounding injection well No. 20. According to our estimates, the gas and propane in this area have served their purpose and water is now displacing the oil that has been banked up on the lease as a result of the miscible-phase displacement.

Alternate injection of gas and water will continue in wells Nos. 2 and 9 until the total gas requirement is injected. Then water alone will be injected at a high rate until the miscible portion of the flood is completed. After this, the pressure will be allowed to decline.

Conclusions

The propane - gas - water injection process has proven to be a practical means of increasing oil recovery. The results to date indicate the project is proceeding largely according to plan. There have been variations in performance, but it was impossible to predict these variations using conventional core analysis, injectivity profiles, and buildup-curve analysis. Also, the pressure in the southern area may have been low enough to cause breakthrough of some strata at the start of the project.

It is likely this type of process could be applied with equal results in most of Slaughter field, and the same type of performance can be expected from a pay similar to the San Andres. It is hoped the information obtained during the life of this project can be used to extend the use of this process to other types of reservoirs.

Nelson Refinery Cost Indexes

Published in the first issue each month in the Technology-Operation Section.

Compiled by W. L. Nelson, Technical Editor and petroleum-refinery consultant, Tulsa.

Charts of the indexes are published each year in late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the month of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis)

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1957	1958	1959	Feb. 1960
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	227.0
Electrical machinery	134.9	160.0	188.9	192.7	195.8	198.3
Internal-combustion engines	126.0	150.5	173.9	178.3	178.5	178.0
Instruments	127.8	154.6	167.4	194.9	201.0	198.6
Heat exchangers	140.0	171.7	203.6	181.2	178.9	195.7
Misc. equipment average	126.2*	160.7	192.1	192.4	196.1	199.5
Materials component	149.5	174.6	201.9	204.2	207.8	208.6
Labor component	144.0	183.3	208.6	220.4	231.6	237.4
Nelson construction index	146.2	179.8	205.9	213.9	222.1	225.9

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis)

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1958	1959	Jan. 1960
Fuel cost	49.6	81.0	86.5	102.1*	103.5	105.4
Labor cost	73.1	88.7	90.9	105.0	102.3	97.3
Wages	52.4	81.5	88.7	105.4	111.5	111.1
Productivity	68.3	90.2	97.1	100.3	109.0	114.2
Investment, maintenance, etc.	51.2	83.6	92.0	109.5	113.7	115.8
Chemicals cost	37.0	72.1	85.7	104.4	107.8	114.2
Operating cost indexes:						
Refinery	58.5	80.5	88.7	105.8*	106.8	106.6
Process units†	62.9	82.2	88.4	105.8	106.0	104.5

†Add separate index for chemicals, if any are used.
*Revised.

BY W. L. NELSON
Technical Editor and Petroleum Consultant

Questions on TECHNOLOGY

Are depreciation allowances inadequate?

Are depreciation allowances inadequate?

In several of your writings you indicate that the depreciation rates allowed by tax law are inadequate. How can such a situation persist? Why don't other people take the same position? R.D.P.

There is probably almost universal agreement on the inadequacy of the depreciation rates allowed by the tax laws unless perhaps the accountants of tax-accounting agencies would not agree. Note the many references on the subject of depreciation rates and the effect of inflation. An excellent review of the cost literature is published each year (usually in May) by J. B. Weaver in Industrial and Engineering Chemistry, and many of the references shown here were taken from these reviews.

Depreciation was originally defined to represent an amortization fund which year by year gained in value until at the end of the depreciation period, the money with which to replace the wornout equipment would be available. Most naturally, this led to the establishment of rules and rates by the Internal Revenue Service as stated in the familiar Bulletin F.

During the last few years these rates have been totally inadequate as a representation of amortization or obsolescence costs. Inflation in the cost of machinery and process equipment has occurred remorselessly each year until there is no longer a clear relationship between first cost and replacement costs at later dates.

Thus the word "depreciation" can no longer be used in its original sense because now it has little practical meaning except its meaning in connection with income-tax returns.

The word depreciation having lost its original meaning can be misleading. Accordingly, in the operating costs of the Process Costimating series, depreciation is not included (as such) in the operating costs. The costs that must be cared for are:

1. Replacement of worn-out plant or equipment.
2. Possible early replacement because of obsolescence.
3. Interest on bonded indebtedness.
4. Dividends on stock.

All of these are obviously more closely related to replacement costs than to original investment and should be carried as a percentage of (or in relation to) the replacement cost.

In Canada, the rental rates of construction equipment are pegged to replacement cost rather than to original cost. Thus they reflect current prices rather than prices that may be months or years out of date. The Canadian rates are discussed in the September 18, 1958, issue of the Engineering News Record, page 50.

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W. L. NELSON, Technical Editor and Petroleum Consultant

COSTimating

Itemized Cost Indexes

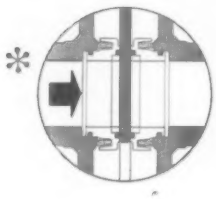
THE COST INDEXES may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction and Operating Cost Indexes are published in the first issue each month of The Oil and Gas Journal.

	1950	1954	1957	1958	1959	Feb. 1959	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Operating costs (based on 1956 as 100.0):								
Power, electrical, industrial	97.3	¶98.5	¶101.6	102.8	103.2	104.7	Code 541-03	
Fuel, refinery	70.3	86.5	¶112.0	¶102.1	103.5	105.8		No. 4, Mar. 17, 1958
Gulf cargoes	78.0	85.9	123.8	102.9	93.5	93.5		No. 4, Mar. 17, 1958
N. Y. barges	76.9	82.6	112.3	93.0	85.9	85.9		No. 4, Mar. 17, 1958
S. Pedro bunkers	65.9	84.3	129.2	114.6	99.5	99.5		No. 4, Mar. 17, 1958
Oklahoma	77.7	62.0	105.3	66.3	78.8	77.8		No. 4, Mar. 17, 1958
Natural gas at wellhead	60.2	¶93.5	¶110.1	¶118.3	130.3	138.7	Code 531-01	
Industrial chemicals	83.3	96.9	101.9	101.8	102.1	102.4	Code 61	No. 58—Oct. 12, 1959
Phosphoric acid	86.7	96.6	100.9	103.4	103.4	103.4	Code 611-07	No. 58—Oct. 12, 1959
Sulfuric acid	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	No. 58—Oct. 12, 1959
Ammonia	104.8	103.0	98.3	103.8	105.1	106.5	Code 611-13	No. 58—Oct. 12, 1959
Lime	64.6	92.0	106.4	104.4	106.1	106.8	Code 611-29	No. 58—Oct. 12, 1959
Sodium carbonate	75.5	92.9	104.3	104.3	104.3	104.3	Code 611-65	No. 58—Oct. 12, 1959
Sodium hydroxide	76.3	90.9	103.6	112.6	115.7	115.7	Code 611-69	No. 58—Oct. 12, 1959
Sodium phosphate	87.5	95.5	101.1	104.6	104.6	104.6	Code 611-71	No. 58—Oct. 12, 1959
Furfural	79.0	100.0	100.0	100.0	100.0	100.0	Code 612-63	No. 58—Oct. 12, 1959
MEK, drums	80.0	94.5	105.2	106.9	103.3	103.3	Ch. & E. News	No. 58—Oct. 12, 1959
Phenol	81.3	90.4	103.2	102.7	96.8	95.2	Code 612-83	No. 58—Oct. 12, 1959
TEL	94.1	102.8	101.5	99.9	100.7	100.6	Supplier	No. 58—Oct. 12, 1959
Operating labor (wages)	72.0	88.7	103.9	105.4	¶111.7	111.3	Employ. & Earn.	No. 55—Nov. 3, 1949
Productivity	85.5	97.1	98.0	100.3	¶108.7	111.6	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	196.3	205.1	214.6	....	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	148.1	192.1	221.0	235.7	248.6	....	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	144.0	183.3	208.6	220.4	231.6	237.4		No. 61—Dec. 15, 1949
Equipment or Materials (1946 = 100):								
Arc-welding machinery		158.4	186.6	193.2	192.1	192.3	Code ‡1176	May 2, 1955§
Boilers, tanks and sheet metal	†136.0	147.3	176.3	175.1	177.2	181.6	Code 1072	April 21, 1952§
Building materials (nonmetallic)	127.0	143.6	159.9	161.7	163.5	164.1	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	132.5	144.7	161.3	162.4	166.4	168.4	Code 1341	No. 20, Mar. 3, 1949
Brick—fireclay	153.4	193.1	232.7	238.7	244.4	244.4	Code 1342	May 30, 1955§
Castings (foundry products)	152.9	181.1	220.5	227.2	231.6	231.0	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	184.0	187.0	191.4	192.7	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	125.3	142.1	159.7	163.2	164.7	166.7	Code 132	No. 22—Mar. 17, 1949
Concrete products	124.4	138.5	149.0	151.0	152.9	154.8	Code 133	
Electrical machinery	134.9	159.9	¶188.6	192.7	195.8	198.3	Code ‡117	May 2, 1955§
Motors and generators	135.0	157.7	181.2	186.4	186.4	187.5	Code ‡1173	No. 31—May 19, 1949
Switch gear		171.2	¶212.0	218.8	223.5	225.6	Code ‡1175	May 2, 1955§
Transformers	131.6	161.9	188.0	187.3	188.6	185.5	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	126.0	150.5	173.9	178.3	178.5	178.0	Code ‡1154	No. 36—June 23, 1949
Exchangers	140.0	¶171.7	203.6	181.2	179.3	195.7	Manufacturer	No. 2—Oct. 28, 1948
Copper base	....	¶190.7	191.4	168.8	169.6	186.3	Manufacturer	
Steel	....	¶156.8	213.2	190.0	186.4	203.0	Manufacturer	
Fans and blowers	162.9	192.6	236.1	241.7	244.4	244.1	Code 1174	Feb. 17, 1949§
Hand tools	143.2	173.8	214.3	224.7	230.4	232.4	Code 1042	June 27, 1955§
Instruments (composite)	127.8	154.6	187.4	194.9	201.0	198.6	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	114.0	161.6	203.3	209.9	219.1	219.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	138.5	179.6	208.2	216.3	223.5	223.5	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	135.5	146.5	171.2	176.4	178.1	174.8	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	134.0	167.2	230.9	240.4	258.9	240.8	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	134.1	150.5	204.6	212.6	231.6	231.6	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	135.6	166.3	189.3	200.0	200.0	200.0	Manufacturer	No. 34—June 9, 1949
Pressure gage	101.2	108.6	119.2	119.2	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	124.0	152.8	171.8	179.7	179.7	179.7	Manufacturer	No. 34—June 9, 1949
Control valve	133.3	162.0	187.8	199.3	199.3	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	193.0	197.8	201.8	198.9	214.1	212.1	Code 81	No. 7—Dec. 2, 1948
Southern pine	176.9	181.2	187.6	184.7	190.9	192.5	Code 812	No. 7—Dec. 2, 1948
Other soft woods	230.2	252.7	257.6	251.2	266.8	261.4	Code 813	No. 7—Dec. 2, 1948
Machinery:								
General purposes	136.7	159.9	196.5	199.6	206.0	209.6	Code 114	Feb. 17, 1949§
Construction	140.1	165.9	199.4	209.6	217.0	219.3	Code 112	
Oil field	†135.8	†161.9	193.2	192.5	192.6	193.1	Code 1151	Oct. 10, 1955§
Paints—prepared	140.0	159.0	178.1	180.9	179.9	180.9	Code 621	May 16, 1955§
Pipe:								
Sewer	120.7	140.1	168.0	170.1	176.2	177.2	Code 1345	No. 22—Mar. 17, 1949
Black iron	160.0	195.0	256.1	264.8	263.8	263.8	Code 1014-56	No. 19—Oct. 15, 1956
Six-inch line	†159.0	200.5	268.3	276.9	275.9	275.9	Code 1014-58	May 4, 1957§
Pumps, air compressors, etc.	138.2	166.5	206.7	214.7	226.5	227.0	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	152.9	179.6	224.5	228.2	232.4	231.8	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	153.7	187.1	232.5	240.6	244.7	244.7	Code 1014	July 25, 1955§
Plate		187.0	241.8	252.7	257.4	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	162.7	193.4	252.2	262.8	268.5	268.5	Code ‡1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	149.5	199.4	265.4	277.5	285.1	281.5	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†135.8	197.1	243.4	242.7	257.6	269.7	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	205.9	213.9	222.1	225.9		No. 36—Aug. 5, 1957
Nelson Refinery Operation (1956)	72.4	88.7	¶106.7	¶105.8	106.8	107.4		No. 2—Mar. 3, 1958
Nelson Refinery Process Operation (1956)	75.1	88.4	¶107.7	105.8	106.0	105.8		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."
†Estimated base value for 1946.
‡Not exactly the same items as those published before July 7, 1952.
§Questions on Technology, The Oil and Gas Journal. ¶Revised.

Marvin Grove talks to pipeliners—

THE HEART OF OUR VALVES IS RIGHT HERE



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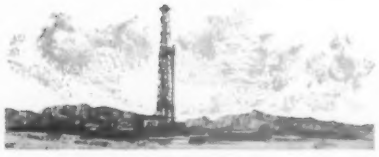

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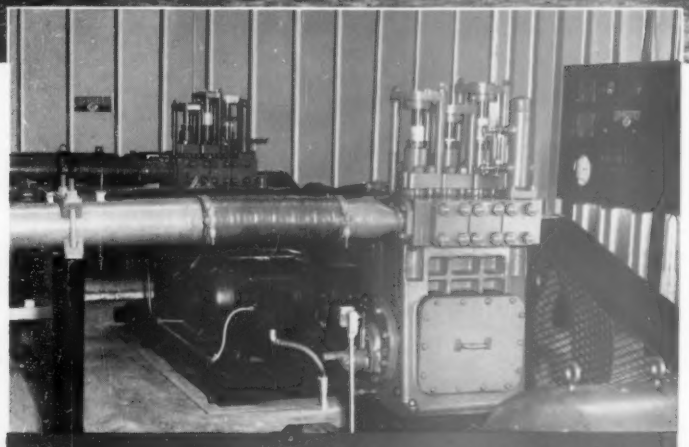

4500 barrels per day at 1200 lbs. psi flow through the unit's water flood system, pumped by two 4" stroke vertical triplex pumps with 60 hp electric motors.

WF1-0

In designing this water flood project near San Angelo, Texas to meet specifications of Hiawatha Oil & Gas Company as Operator of the Yan-Kee (Canyon) field unit, our engineers faced a corrosive water situation.* But long-term, trouble-free operation was designed into this job with proper corrosion resistant equipment. For example:

- Clear water tank and filters are coal tar epoxy coated.
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*Cambrian water; specific gravity, 1.075 at 60°F; pH 6.8; temperature leaving supply well at 138°F.

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The

FOREMAN'S PAGE

PART 10
FLUID FLOW

Quiz on fluid flow

● Concluding a 10-part series on fluid flow, here are 10 questions on most of the principles involved.

Please put a check (√) mark opposite the right answer.

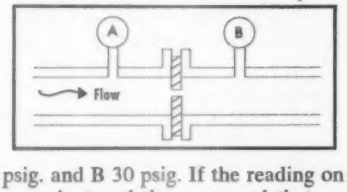
1. The viscosity of fluid A is 100 S.s.U. at 100° F. and fluid B 200 S.s.U. at 100° F. Which fluid will offer the greater resistance to flow through the same pipe at the same temperature?

.... (a) Fluid A.
.... (b) Same for both.
.... (c) Fluid B.

2. Turbulent flow is

.... (a) The flow of a fluid in straight unbroken lines.
.... (b) The flow in which the entire mass is a mixture of swirls and eddies.
.... (c) The flow of a fluid in smooth unbroken layers.

3. Suppose gage A below reads 40



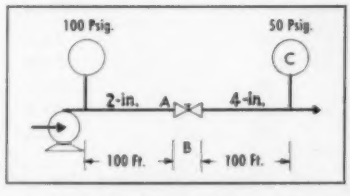
psig. and B 30 psig. If the reading on gage A stayed the same and that on B went down to 20 psig., the ΔP across the orifice has

.... (a) Increased.
.... (b) Decreased.
.... (c) Stayed the same.

4. The pressure drops, per 100 ft. of pipe, for water flowing through 2-in. and 4-in. pipe at the rates listed below are:

G.p.m.	Δ P — psi./100 ft. 2-in.	4-in.
100	9.5	.5
200	37.5	1.5

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division of Humble Oil & Refining Co.



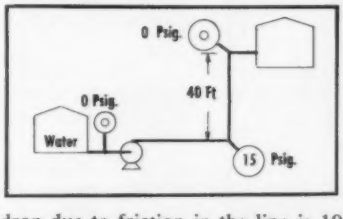
With the above piping arrangement, we are pumping 200 g.p.m. of water and maintaining a 100-psig. discharge pressure on pump.

(a) What is pressure reading at point A in system?

(b) What pressure drop is being taken across valve B to give the 50-psig. pressure at point C in system?

.... psig.
.... psig.

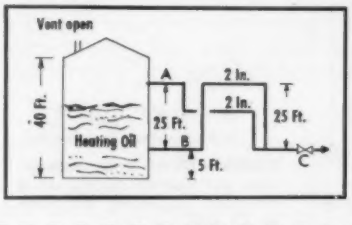
5. In the diagram below, when P_1 is pumping 200 g.p.m., the pressure



drop due to friction in the line is 19 psi. What is the approximate rate of water flow?

.... (a) 200 g.p.m.
.... (b) Zero.
.... (c) 100 g.p.m.

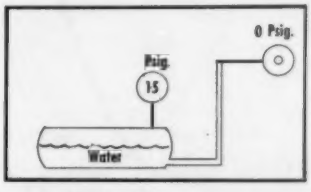
6. Referring to the diagram below, if we open valve C the flow rate of heating oil from the tank will be



(neglect resistance offered by fittings)

.... (a) Greater in pipe B than A.
.... (b) Greater in pipe A than B.
.... (c) Same in both lines.

7. In the system below, how high is water in line above water in drum?

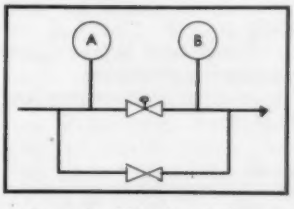


.... (a) 34.5 ft.
.... (b) 15 ft.
.... (c) No difference.

8. When the rate of flow through an orifice is increased

.... (a) The pressure on both sides of the orifice remains the same.
.... (b) The pressure drop across the orifice will increase.
.... (c) The pressure drop across the orifice will decrease.

9. In the sketch below if pressure



gage A reads 40 psig. and pressure gage B reads 30 psig. and the control valve is wide open, the rate of flow

.... (a) Cannot be increased.
.... (b) Can be increased by opening the bypass valve.
.... (c) Can be increased by reducing the 40 psig.

10. Which will pass more oil with a given pump through equal lengths of line?

.... (a) One 12-in. line.
.... (b) Three 6-in. lines.
.... (c) Two 8-in. lines.

FLUID FLOW QUIZ ANSWERS

1. (c) Fluid "B."
2. (b) The flow in which the entire mass is a mixture of swirls and eddies.
3. (a) Increased.
4. (a) 62.5 psig.
   (b) 11.0 psig.
5. (b) Zero.
6. (c) Same in both lines.
7. (a) 34.5 ft.
8. (b) The pressure drop across the orifice will increase.
9. (b) Can be increased by opening the bypass valve.
10. (a) One 12-in. line.

24. How to analyze capillary-pressure data

BY E. T. GUERRERO
AND
F. M. STEWART

GIVEN: Capillary-pressure curves measured on 75 cores taken at random from cored intervals of a sandstone reservoir. Five of these curves are shown in Fig. 1. Other data obtained were as follows:

σ_{ow}, interfacial tension, oil-water at reservoir conditions = 33 dynes/cm.

σ_w, surface tension, water-air at test conditions = 71 dynes/cm.

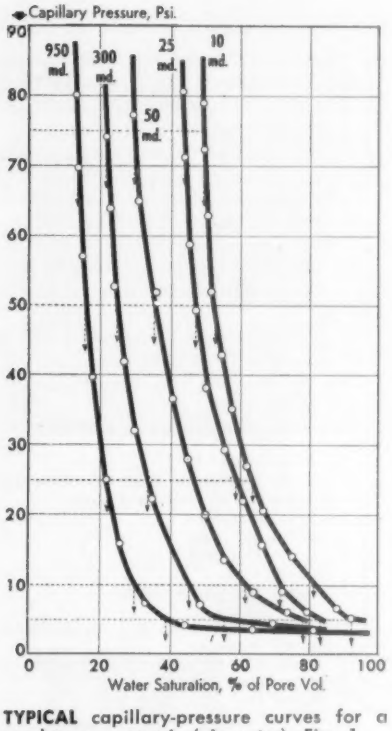
ρ_w, density of brine at reservoir conditions = 0.45 psi./ft.

ρ_o, density of the reservoir oil at reservoir conditions = 0.31 psi./ft.

k_{av}, average absolute permeability for reservoir obtained from some 1,000 samples analyzed = 155 md.

FIND:

1. Correlations between permeability and water saturation.
2. Average capillary-pressure curve for reservoir.



TYPICAL capillary-pressure curves for a sandstone reservoir (air-water). Fig. 1.

TABLE 1—PERMEABILITY VS. WATER SATURATION AT CONSTANT CAPILLARY PRESSURE

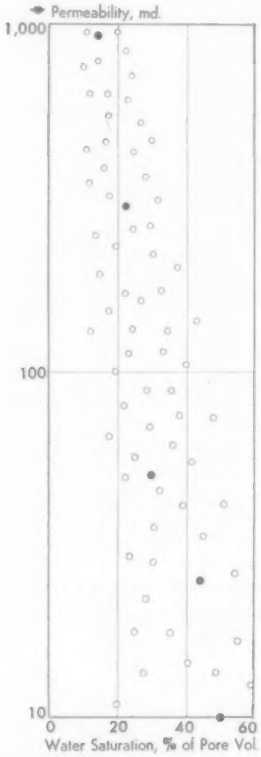
Permeability	Water saturations for constant capillary pressure, % — 75 psi.	50 psi.	25 psi.	10 psi.	5 psi.
950	14.0	16.5	22.0	30.0	39.0
300	22.5	25.5	34.0	45.5	56.0
50	30.0	36.0	47.0	61.5	78.0
25	44.5	47.5	59.0	71.5	83.0
10	50.5	53.0	63.5	81.0	92.0

3. Conversion factor for relating capillary-pressure scale with subsurface elevation from free water level.
4. Minimum interstitial-water saturation.

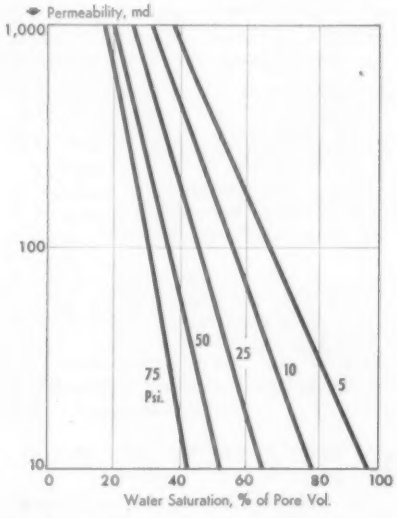
METHOD OF SOLUTION:

1. Fig. 1 shows 5 typical capillary-pressure curves of the 75 involved in this problem. Each curve was obtained from an individual core, the permeability of which is noted on the curve. Using a constant capillary pressure of 75 psi., the water saturation for each curve was read and plotted on Fig. 2 versus permeability. Table 1 shows the values read from Fig. 1 for constant capillary pressures of 75, 50, 25, 10, and 5 psi.

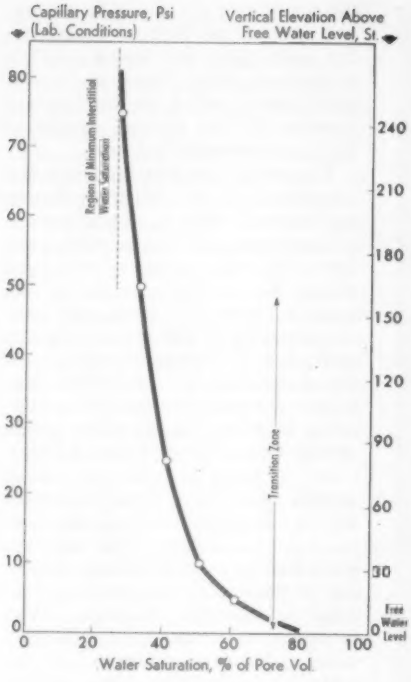
An average linear line is drawn through the data to give the relation between permeability and water saturation at constant capillary pressure. (This was done for the 75-psi. capillary pressure in Fig. 2.) Curves for five capillary pressures are shown in



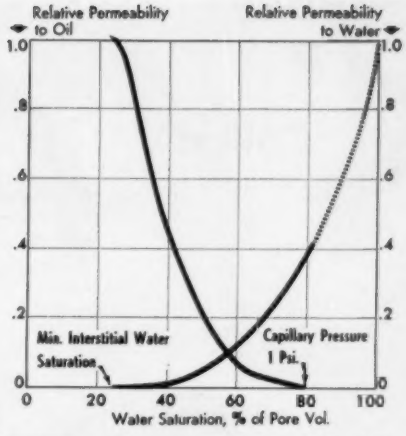
VARIATION of water saturation with permeability at a constant capillary pressure of 75 psi. Fig. 2.



VARIATION of water saturation with permeability at selected capillary pressures. These were obtained in the manner of the single curve in Fig. 2. Fig. 3.



DATA from Fig. 3 were read at an average permeability of 155 md. and used to plot this average reservoir capillary-pressure curve. Fig. 4.


Relative Permeability to Oil
Relative Permeability to Water
Min. Interstitial Water Saturation
Capillary Pressure 1 Psi.
Water Saturation, % of Pore Vol.

TYPICAL oil - water relative-permeability curves for average rock properties of the reservoir under study. Fig. 5.

Fig. 3; these were derived individually in the same manner as for the 75-psi. curve.

2. Figs. 1, 2, and 3 show an acceptable method for averaging capillary - pressure data. From all the core-analysis data an average reservoir permeability is found and used to obtain the reservoir average capillary-pressure curve from the average data of Fig. 3. The data of Table 2 were read from Fig. 3 for an average reservoir permeability of 155 md. and are plotted in Fig. 4. The average conditions of Fig. 4 are shown by the comparable and typical oil and water relative-permeability curves of Fig. 5. The latter were drawn to show the relation between capillary pressure and relative-permeability curves.

TABLE 2—AVERAGE RESERVOIR CAPILLARY-PRESSURE DATA

(k_{av} = 155 md.)

Capillary pressure (psi.)	Water saturation (%)
75	27.0
50	33.0
25	41.0
10	51.0
5	61.5

3. Correlation between capillary pressure and distance from free water level can be found from the given data and the equation:

$$P_{cL} = \frac{\sigma_w}{\sigma_{ow}} (\rho_w - \rho_o)\, h \qquad (1)$$

$$P_{cL} = (71/33)\ (0.45 - 0.31)\ h$$

$$P_{cL} = (2.15)\ (0.14)\ h = 0.301\ h$$

$$\text{or} \quad h = 3.3\ P_{cL}$$

In this case 3.3 is the factor for relating mean laboratory capillary pressure data with corresponding subsurface vertical distance from the free water level (lower end of transition zone or highest elevation at which 100% water saturation is encountered).

4. From Fig. 4 it is seen that the minimum interstitial-water saturation is about 26.0%.

DISCUSSION: Capillary pressure is defined as the pressure difference across an interface between two fluid phases.[1,2] It is given by the equation:

$$P_c = \sigma\ (1/R_1 + 1/R_2) \qquad (2)$$

and also by the equation:

$$P_c = \Delta\rho gh \qquad (3)$$

Considering Equation 2 at laboratory and reservoir conditions and Equation 3 at reservoir conditions, it is easy to develop Equation 1 which relates laboratory and reservoir conditions.

In using these relations the following assumptions are made: (1) Laboratory cleaning and other processing does not change the matrix surface characteristics of the rock; (2) rock is 100% water wet; (3) radii of curvature in reservoir and at laboratory conditions are identical; (4) reservoir was initially fully saturated with water which was subsequently displaced by hydrocarbons; the water displacement was not complete but enough water was retained to satisfy the capillary forces; (5) at discovery the reservoir contained amounts of water and hydrocarbons equivalent to those required for equilibrium between gravitational and capillary forces.[3]

Obviously the first three assumptions are very difficult to satisfy fully. Laboratory restored-state procedures are believed to alter the wetting and other grain surface properties of the rock. The degree of alteration and its final effect on the results are not too well known. Most reservoir rocks are believed to be preferentially wet with water; but there are many which are apparently oil wet, including some of the larger important fields.

Capillary-pressure data have long been used in finding reservoir interstitial-water saturation. It is necessary to analyze enough cores for a lease or reservoir to assure average statistical results. In this case (large reservoir) 75 samples were analyzed. Fig. 1 shows the capillary-pressure curve for five of the samples. Note that the capillary pressure increases as the water saturation decreases. A point is reached where large changes in pressure do not change the saturation appreciably. This region of the curve gives the so-called minimum interstitial-water saturation. Another characteristic of some of these curves is that a considerable amount of desaturation may take place with a comparatively small increase in capillary pressure. This is true of the curve for the 950-md. sample. Such behavior indicates a fairly uniform sample. The capillary pressure at which

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the nonwetting phase (oil in a water-wet system) can first be forced into the pores (i.e., the lowest capillary pressure at which there is some oil saturation) is called the displacement pressure. In the 950-md. sample of Fig. 1 this pressure is 3 psi.

Theoretical concepts indicate that permeability and capillary pressures are related.[3] That is, for a particular reservoir rock and a given water saturation, the capillary pressure should be increasingly greater for samples arranged in decreasing order of permeability. This phenomenon is noted in Fig. 1. However, the scattering of data in Fig. 2 show that other factors are also influential. The scattering of points for the other graphs of Fig. 3 was similar to that of Fig. 2.

Fig. 4 shows the average reservoir capillary-pressure curve obtained from Fig. 3, using the average reservoir absolute permeability. Note that this graph has two capillary-pressure scales, one at laboratory conditions and the other at reservoir conditions. With this graph it is possible to obtain a value of the water saturation (for the average permeability rock) at any point above the free water level. For instance, at 90 ft. the water saturation is 40%.

If desired, the curves of Fig. 3 can be used to determine the mean capillary-pressure curves of segments of the reservoir. From core data for each respective segment, average permeabilities are computed and used with Fig. 3. A problem that will be treated later will illustrate the reservoir segment approach.

Many engineers and geologists define the oil-water contact as the lowest elevation at which water-free oil production can be obtained.

The maximum water saturation below which only free oil will be produced is of course defined by the oil-water relative-permeability characteristics of the reservoir rock with its reservoir fluids.[4] Fig. 5 shows that even at a water saturation of 40% very little water is flowing and essentially only oil is flowing. Where applicable relative-permeability data are not available, it is usually assumed that water saturation in the free oil productive zone is represented by that corresponding to 45 to 75 psi. capillary pressure.

For clean sands (of good to high porosity and permeability) this is a reasonable assumption because the transition zone is only a few feet in height, and the minimum interstitial water value may be approached on the order of 10 ft. or so above the free water level. Furthermore, there is little difference in the water saturation at that level and at higher levels with

their correspondingly higher capillary pressures.

In dirty or tight sands, the minimum interstitial-water saturation may be reached only at comparatively high capillary pressures.

In such cases, there is a considerable variation in water saturation with height within the free-oil productive zone. Here the broad assumption of 45 or 75 psi. for capillary pressure may lead to sizable error.

The transition zone is defined as that interval in which the saturations are such that both oil and water flow. Here again this interval is defined by the oil-water relative-permeability data for the reservoir rock and its fluids. Where oil reserves are believed to exist in this zone, the determination of average reservoir water saturation becomes more complex. An illustration involving such a case will be covered in a later problem.

The capillary method of interstitial-water - saturation determination has been found to be good (in many fields) for points above the transition zone.[1] For such conditions, laboratory measurements can be restricted to a data point per sample taken at a pressure sufficiently high to assure minimum water saturation. If enough points are obtained to define the capillary-pressure curve, the testing becomes tedious, time consuming, and expensive.

Comparisons[1] have been made between water saturations determined by analysis of oil-base mud cores and the capillary-pressure method. Agreement was usually found to ge good. Cases have been found, however, where large differences existed, generally when the actual reservoir interstitial-water saturation was rather low, 15% or less. Such low water saturations indicate possible oil-wetting conditions. Laboratory restoration of oil-wet cores may well result in changing wetting characteristics and thus explain the discrepancies encountered.

Nomenclature

h = subsurface vertical elevation from free water level, ft. R_1 and R_2 are radii of curvature of fluid interfaces. All others are standard AIME symbols (Journal of Petroleum Technology, October 1956).

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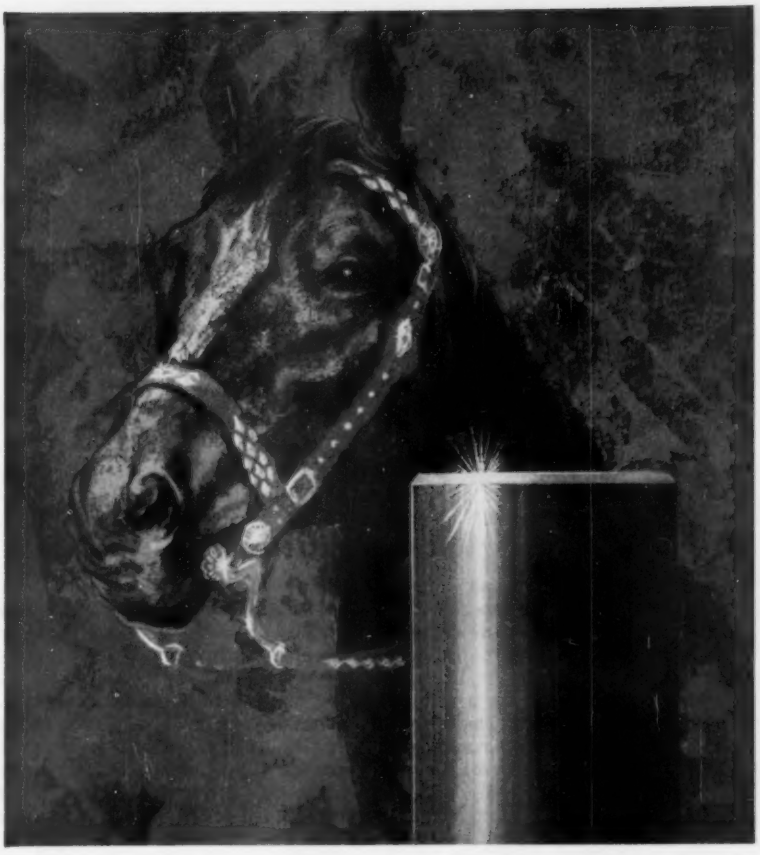

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PART 3
(CONCLUSION)

What to do when a well "KICKS" while making a trip

BY T. B. O'BRIEN
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and
W. C. GOINS, JR.
Gulf Research & Developments Co.,
Harmarville, Pa.

ONLY TWO THINGS can cause a well to flow while the pipe is being pulled. Either the well is swabbed as the drill pipe is pulled or the crew fails to fill the hole.

Swabbing is caused by a number of things. You should know these causes and be prepared to neutralize them. There is no excuse for not filling the hole.

From 50 to 70% of all blowouts occur while making a trip.[1] Strangely enough, we have directed most of our efforts toward killing kicks that occur while drilling is in progress; these are much less frequent.

The time we consider here is from the moment drilling ceases and the bit is pulled off bottom until it is back on bottom and drilling again. We must assume that the mud is heavy enough when drilling stopped to overbalance, at least slightly, the formation pressure. This being the case, only swabbing or failure to fill the hole can cause a "kick."

Avoid high gels. Mud with too high gel strength often causes swabbing. This was proved in 1934.[2] Since that time, gel properties of drilling muds have been reduced in the areas where swabbing troubles are the worst. However, in some areas, many still run muds with high viscosities and attempt to run low gel strengths.

Some muds are purposely still run with high gel strengths. Regardless of any other consideration, this is dangerous.

There may be trouble even with muds which have low gel strengths measured for the 10 minutes at ambient temperature. Very often, these actually develop higher gels at bottom-hole temperature in the time required to make a trip. This is the case in most conventional muds, i.e., red muds, lime muds, phosphate muds, etc. This type gel may be much more dangerous than that which builds rapidly and is characterized by almost equal initial and 10-minute gels. The first type is known as a slow gel, the second as a flat gel.[3]

This is not intended as a recommendation against the muds mentioned. Rather it recommends that when these muds are being run, the solids content be run at the lowest practical level and care taken to keep minimum gel strengths and gel rates. It is also necessary to be more careful when making a trip to be certain there is no swabbing.

Although it is not as critical as gel strength, viscosity can also be a serious factor in swabbing. Viscosity being resistance of fluid to flow, there is a tendency for the mud column to rise with the drill pipe as it is pulled. This reduces bottom-hole pressure. The tendency to move with the drill pipe increases as the viscosity increases. At very high viscosity the drop in bottom-hole pressure may cause formation fluid to flow into the hole.

High gels and high viscosity coupled with small annular clearance, very regularly produce swabbing. These conditions occur in almost every deep well using high-weight mud and in shallow slim holes with mud only slightly heavier than water. Little can be done as a run to increase annular clearance, but mud properties can be arranged to keep swabbing to a minimum.

When is it swabbing? It is often most difficult to detect swabbing. That is the reason so many blowouts occur during a trip. The difficulty in detecting swabbing results from the fact that, although the hole takes some mud when it is filled, it does not take all it should. Only a few drilling rigs can accurately measure the volume of mud in the active pit or the volume pumped into the hole.

A driller may use several methods to add mud to the annulus, if he fills it at all. He may run a pump on the fillup line continuously or he may at intervals fill the hole until it runs over. Or, if the drill pipe will not pull dry with the hole full, he may put just a small amount of mud in the hole at intervals. In no case can he tell how much mud he has put into the hole.

Swabbing could occur in some cases and not be known until the well was flowing at a tremendous rate or unless the driller happened to look when the pit ran over. Furthermore, the initial effects of swabbing are so slight that quite accurate measurements of mud volume are required to detect swabbing in its early stages.

Table 1 gives the displacement of common sizes and weights of drill pipe. It can also be used for accurate measure of the volume required to fill the hole while making a trip.

Table 2 gives the amount of mud gained when drill pipe is pulled from the hole and there is swabbing. At 100% swabbing, the hole would stand full as the drill pipe is pulled; it would take no mud but it would gain none. Percentages less than 100 indicate that fraction of the drill-pipe displacement which the hole does not take as the pipe is pulled.

Sometimes, swabbing goes beyond the point of the hole standing full. In fact, the entire hole volume may be swabbed as it would be by a balled-up bit or a dragging packer. This sort of thing should be obvious and no

"The difficulty in detecting swabbing results from the fact that, although the hole takes some mud when it is filled, it does not take all it should. Few drilling rigs can accurately measure mud volume in the active pit or volume pumped into the hole."

This is Part 3 of a three-part series. Part 1 appeared in the Journal of June 20 and Part 2 in the issue of June 27. This series is adapted from a paper presented at 1960 spring meeting of API Division of Production's Southern District, San Antonio.

When mud-pit volume gains . . .

1. Stop pumps and close well in completely. If off bottom, install back-pressure valve and return to bottom.

2. Read drill-pipe and annulus pressures.

3. Open well on choke of such size that, with the pump running at a reasonable and constant speed, the choke pressure will be about 200 psi. above the initial annulus pressure.

4. From this time, keep the drill-pipe pressure constant, making changes in choke size as necessary to keep the drill-pipe pressure constant. The choke pressure can be ignored unless it gets high enough to burst the casing; then, and only then, should the choke be increased to relieve the choke pressure.

5. Calculate mud weight required to kill the well, using the formula below. As the mud weight is increased, make corrections in the drill-pipe pressure. The drill-pipe pressure will decrease as the mud weight increases. When mud weight is as high as required, the drill-pipe pressure should be that normally required to circulate at the pumping rate used.

Formula to determine required mud weight:

$$\text{Mud weight required} = \text{mud in use} + \frac{\text{drill-pipe pressure}}{0.052 \times \text{depth}}$$

special methods are required for its detection. Under no circumstances should it be allowed.

Small volumes. The insidious nature of swabbing is that it involves such a small volume of mud when a hole does not take all the mud it should. It is apparent that most swabbing cannot be detected by the usual method of checking the pit level. We very often lose more mud than indicated here by pulling a few wet stands.

In most such cases swabbing is indicated by gas or water-cut mud after a trip. In these instances swabbing occurs for a few stands, then after the bit is up the hole a way the hole takes all the mud it should.

Occasionally swabbing is not detected and it continues as the bit or other tools are pulled. The 20 to 60-psi. loss in bottom-hole pressure becomes 200 to 600 psi.; and before we get back in the hole, the bottom-hole pressure has been reduced to the extent that the well flows a noticeable volume of mud. With higher mud weights and deep wells, this loss in pressure becomes greater.

These facts further prove the value of a small active mud pit. But the primary concern is to accurately measure the amount of mud used to fill the hole each time. Of course, we know the displacement of the drill pipe being pulled. With these two, the driller will know immediately if the well starts to "follow him out of the hole."

Fill often. Another practice which was once common, but which should be almost nonexistent now, is that of not filling the hole at all. For this there is no excuse! Any time a well is being drilled with a fluid other than air or gas it should be filled as the pipe is pulled from the hole. To fail to do this is gross neglect. Nothing can be gained by not filling the hole, and everything could very easily be lost.

Further, too long a time should not be allowed between fillings of the hole. Experience generally indicates a reasonable procedure; but, unless conditions are such that swabbing can easily occur, the hole can be filled once each 10 stands for 8⅝-in. holes and larger and once each 5 stands for holes smaller than 8⅝ in.

If swabbing is known to be a problem, the hole should be filled after each stand or possibly each second stand.

An indication of how often swabbing occurs is the frequency that trip gas or water-cut mud appears after a trip. Very often, mud weight is raised to eliminate trip gas, but this is a poor substitute for good operation and should only be done as a last resort. It is far better to eliminate the causes of swabbing than to raise mud weight and slow drilling rate as well as risk losing circulation.

Another method. Should better mud properties, careful handling of the drill string, and accurate measurement of mud used to fill the hole fail to stop swabbing, there is still another approach. The drill pipe can be stripped out of the hole. A drill-pipe float is not essential for this but would be helpful.

The preventer is closed lightly around the drill pipe. As each stand is pulled, the displacement of that stand is pumped into the annulus. This must be done very carefully to avoid putting too much pressure on the open hole.

This method is not practical on many rigs. If not, the pump can be run on the annulus and on one or more guns or chokes to keep back pressure on the annulus. Doing this requires a method of very accurately and frequently determining the volume pumped into the hole. Usually, if one pit is cut off from the remainder of the system, it will be sufficiently accurate for measuring mud volume.

In a very critical situation an even smaller tank (10 to 20 bbl. calibrated in 1-bbl. increments) serves very well. This method has been used in several cases with good success. But, the operator must know what he is doing to stay out of trouble.

After Well Kicks

There will always be operators who consider a haphazard approach to the problem of blowout prevention to be a calculated risk. So, we may assume that some contractors who work for them will not properly train their crews to prevent blowouts. Therefore, we can expect something less than the best handling of situations which might lead to blowouts. It then follows that we must think about what to do when the well follows the bit out of the hole.

We can probably expect the crew to realize the well is coming in when it flows of its own accord. Then, the idea is to get the well killed with the least damage to the hole. To do this the drill pipe must be as close to bottom as possible, because the nearer the bit is to bottom, the less mud

"Any time a well is being drilled with a fluid other than air or gas it should be filled as the pipe is pulled from the hole. To fail to do this is gross neglect. Nothing can be gained by not filling the hole, and everything could very easily be lost."

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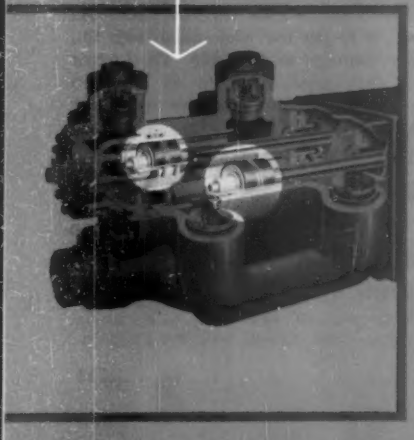

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"When circulating off bottom until returns are up from bottom, keep close watch on pit volume. This, of course, is particularly important if any mud has been gained while making the trip. Some gain in the pit is always to be expected as swabbed fluid is circulated up."

weight is required to kill the well. Indeed, if the bit can be returned to bottom, no increase in mud weight will be required.

Following is an example of the importance of returning the pipe to bottom or as near to bottom as possible:

A well is drilling at 15,000 ft. with 15 lb. per gal. mud. As the bit is pulled to 10,000 ft., the crew discovers the well is coming in. Table 1 gives by percentage of total hole volume swabbed, the mud weight requirements at 10,000, 11,000, 12,000, 13,000, 14,000, and 15,000 ft. This is a sample calculation:

At 10,000 ft., 10% hole volume swabbed:

$15{,}000 \times 0.052 \times 15 =$ original b.h.p. mud $= 11{,}700$ psi.

$$\begin{aligned} 10{,}000 \times 0.052 \times 15 &= 7{,}800 \\ 5{,}000 \times 0.052 \times 15 \times 0.90 &= 3{,}500 \\ & \overline{\quad\quad} \\ & 11{,}300 \end{aligned}$$

$11{,}700 - 11{,}300 = 400$ psi. b.h.p. lost.

$7{,}800 + 400 = 8{,}200$ psi. $b.h.p._m$ (minimum bottom-hole pressure) at 10,000 ft. required to kill well.

$$\frac{8{,}200}{0.052 \times 10{,}000} = 15.8 \text{ lb. per gal.}$$

mud weight required to kill well at 10,000 ft. if 10% of hole volume is swabbed.

TABLE 1—DRILL-PIPE DISPLACEMENT

Size (in. o.d.)	Designation*	Nominal weight (lb./ft.)	Average actual weight (lb./ft.)	Displacement (bbl.) Barrels per foot	One 90-ft. stand	Five 90-ft. stands	Ten 90-ft. stands
2⅜	Tubing T&C	4.70	4.59	0.00167	0.15	0.75	1.50
	Tubing TJ	4.70	5.13	0.00187	0.17	0.84	1.68
2⅞	Tubing T&C	6.50	6.34	0.00233	0.21	1.05	2.11
	Tubing TJ	6.50	7.22	0.00263	0.24	1.18	2.37
	LWDP	6.85	7.33	0.00267	0.24	1.20	2.40
	Drill pipe	10.40	10.90	0.00397	0.36	1.79	3.57
3½	Tubing T&C	9.50	9.20	0.00335	0.30	1.51	3.02
	Tubing TJ	9.50	10.13	0.00369	0.33	1.66	3.32
	LWDP	9.50	10.27	0.00374	0.34	1.68	3.37
	Drill pipe	9.50	10.27	0.00374	0.34	1.68	3.37
	Drill pipe	13.30	13.80	0.00503	0.45	2.26	4.53
		15.50	16.1	0.00587	0.53	2.64	5.28
4½	Tubing T&C	12.75	12.83	0.00467	0.42	2.10	4.20
	Tubing TJ	12.75	14.58	0.00531	0.48	2.39	4.78
	LWDP	13.75	15.08	0.00549	0.49	2.47	4.94
	Drill pipe	16.60	17.80	0.00648	0.58	2.92	5.83
	Drill pipe	20.00	21.60	0.00776	0.70	3.49	6.98
5	LWDP	15.00	17.69	0.00644	0.58	2.90	5.80
	Drill pipe	19.50	20.60	0.00750	0.68	3.38	6.75

*Tubing T&C = tubing with threads and couplings. Tubing TJ = tubing with tool joints. LWDP = lightweight drill pipe.

What volumes mean. Table 3 shows that the more fluid swabbed, the more critical returning to bottom becomes. It also shows the effect which causes gas cutting on trips.

The figures given for mud weight are those which are required to balance the formation pressure. Usually, wells are drilled using at least a 500-psi. overbalance below 10,000 ft. Often this overbalance is 1,000 psi. or more.

Sometimes, as much as 25% is swabbed as the bit is pulled the first 5,000 ft. off bottom (as shown here). Still, the well will not flow. When the bit returns to bottom, this gas or water that has been swabbed in is circulated out. Then we get gas or water-cut returns.

If the foreign fluid is gas or water and gas, we can expect a considerable kick when it reaches the surface. This causes some further reduction in bottom-hole pressure, but it will be fairly small if the well did not flow when the bit was returned to bottom and before the pump was started.

The method of control is quite similar to that given previously for control of a kick while drilling. In this case several things make control easier. First, mud density need not be increased; second, circulating rate and pressure are established. No change need be made in the circulating rate, but circulating pressure must be controlled carefully.

Gain in pits. When circulating off bottom until returns are up from bottom, keep close watch on pit volume. This, of course, is particularly important if any mud has been gained while making the trip. Some gain in the pit is always to be expected as swabbed fluid is circulated up. This means a further reduction in bottom-hole pressure is occurring.

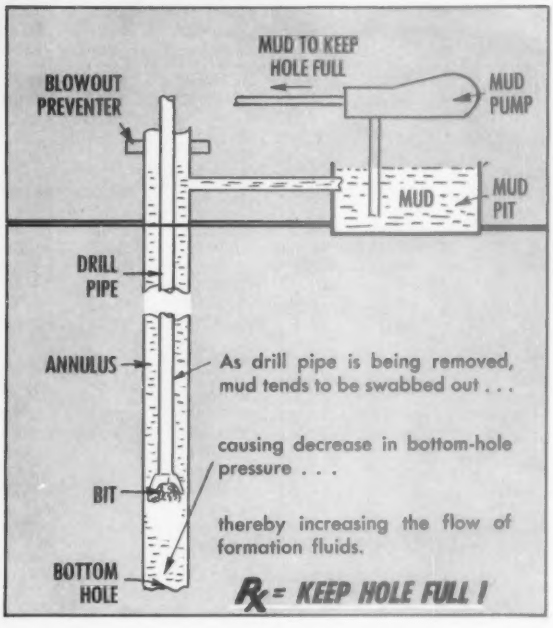
We very rarely know how much overbalance pressure we have for safety. For this reason, we must assume that this expansion of foreign fluid causes the loss of all the overbalance we might have had. The only pressure we have over hydrostatic

TABLE 2—VOLUME GAINED DUE TO SWABBING

Drill pipe (o.d., in.)	Nominal wt./ft.	Displacement 1st stand	Displacement 10 stands	Volume gained* 10%	25%	50%	100%	Hole size, in.	B.h.p. reduction (psi.) when 10 stands pulled, 10 lb./gal. mud 10%	25%	50%	100%
2⅞	10.40	0.357	3.57	0.036	0.089	0.178	0.360	5⅝	6	15	30	60
3½	13.30	0.453	4.53	0.045	0.112	0.224	0.450	6	6.7	17	34	67
4	16.60	0.583	5.83	0.058	0.145	0.290	0.580	8⅝	4.2	11	21	42
								9⅞	3.2	8	16	32
5	19.50	0.675	6.75	0.068	0.169	0.338	0.675	9⅞	3.5	9	18	35
								12¼	2.3	6	11	23

*Volume gained when 10 stands pulled and indicated percentage swabbing occurs. Volume = inches in pit having capacity of 10 bbl. per inch.

How swabbing affects well flow


MUD TO KEEP HOLE FULL
BLOWOUT PREVENTER
MUD PUMP
MUD
MUD PIT
DRILL PIPE
ANNULUS
As drill pipe is being removed, mud tends to be swabbed out . . .
causing decrease in bottom-hole pressure . . .
BIT
thereby increasing the flow of formation fluids.
BOTTOM HOLE
Rx = KEEP HOLE FULL !

pressure of the mud is the annular pressure drop resulting from circulating.

This annulus pressure drop may be from 1 to 0.4 lb. per gal. mud weight. It might hold a well that was swabbed, as shown in Table 3; i.e., 5% for 5,000 ft. In most instances it will not by itself control a flow if the overbalance has been lost.

If we assume that overbalance is lost, then it becomes necessary to close the blowout preventers and put the well on a choke to maintain back pressure. The back pressure required is determined by the drill-pipe pressure rather than casing pressure. In this case the well should be choked just enough to give an indication on the drill-pipe gage.

A choke may not be required, but rather an open line may suffice if the circulating rate is high enough.

When the foreign fluid reaches the surface, the annular pressure will start to fall and a larger opening will be required. The size opening on the annulus should always be selected to keep drill-pipe pressure constant.

Stripping pipe in. The well must not be allowed to flow any more than is absolutely necessary. To prevent the well flowing, a back-pressure valve (inside blowout preventer) should be installed in the drill pipe and the drill pipe stripped back in the hole through the Hydril as far as possible. During stripping, the Hydril must be allowed to leak a small amount as the pipe moves through to lubricate its seal rubber.

If some means of filling the drill pipe is available as it is stripped in, it should be done. In many cases it is absolutely necessary; but in some cases the depth to which the pipe can be run is determined by its collapse resistance (Table 4). The depth to which pipe can be run without filling can be determined by the following formula:

$$\frac{\text{Collapse strength, psi.}}{0.052 \times \text{mud weight, lb. per gal.}} = \text{setting depth, ft.}$$

For example, take 3½-in. o.d. 13.30-lb. per ft. Grade D drill pipe. What is its setting depth in 10-lb. per gal. mud?

$$\frac{9{,}170}{0.052 \times 10} = 17{,}600 \text{ ft., depth to}$$

which 13.30-lb. Grade D 3½-in. drill pipe will run in 10-lb. per gal. mud without filling.

As another example, say we have the same situation except mud weighs 17.5 lb. per gal.

$$\frac{9{,}170}{0.052 \times 17.5} = 10{,}100 \text{ ft., depth to}$$

which 13.30-lb. Grade D 3½-in. drill pipe can be run without filling.

If the pipe is old, use a safety factor of 1⅛. This would make the formula:

$$\frac{\text{Collapse strength, psi.}}{0.0585 \times \text{mud weight, lb. per gal.}} = \text{setting depth, ft.}$$

Our second example above would become:

$$\frac{9{,}170}{0.0585 \times 17.5} = 9{,}000 \text{ ft., depth to}$$

which 13.30-lb. Grade D 3½-in. drill pipe can be run without filling.

Annulus buildup. Another limit on depth to which pipe can be stripped in the hole is the pressure which builds up in the annulus. This limit applies in two ways. First there is the ability of the formations to support the extra pressure in addition to that exerted by the mud left in the hole. Second, there is the ability of the blowout preventer to withstand the pressure.

Remember that drill pipe stripped into the hole displaces a large volume of mud. This mud must be bled off so that annulus pressure does not build up too high.

Should the pressure reach the formation or equipment limit, or should the bit hit a bridge before it gets to bottom, the mud weight to kill the well will have to be higher than that used to drill it. The amount mud weight need be raised can be determined. This is done after the drill pipe has been filled with mud and cleared of air. Then, the pressure required to open the back-pressure valve shows how much extra mud weight is needed.

It is of the greatest importance that this determination of mud weight be made. A correct increase in mud weight gives enough pressure to kill the well without undue danger of breaking the formation down with excess mud weight.

Determining the mud weight required and the method of controlling drill pipe and annular pressures is the

"If we assume that overbalance is lost, then it becomes necessary to close the blowout preventers and put the well on a choke to maintain back pressure. The back pressure required is determined by the drill-pipe pressure rather than casing pressure."

same as proposed in the previous installment of this series.

We have assumed that the well would start to flow as the pipe is pulled from the hole. The same principles apply any other time the bit is off bottom. The thing to do in any case is to get the pipe as close to bottom as possible and allow no more foreign fluid to enter the hole.

"We have assumed that the well would start to flow as the pipe is pulled from the hole. The same principles apply any other time the bit is off botom. The thing to do in any case is to get the pipe as close to bottom as possible and allow no more foreign fluid to enter the hole."

Reverse Circulation

When a well kicks and is closed in immediately, the best method to overcome it from standpoint of pressure control is to reverse out the formation fluid. There are several obvious advantages.

First, the initial closed-in pressure would be the highest ever put on the casing and blowout preventers; the pressure would be confined to a small area which can be closed off by a simple valve above the rig floor. All chokes and such equipment could easily be mounted above the floor. There may be other advantages.

There are, however, several disadvantages which make circulation in the usual manner far better. First, putting pressure on the annulus of a drilling well is always a critical operation; the slightest excess can, and often does, cause lost circulation. In normal circulation, much of the circulating pressure drop occurs in the drill pipe. Thus, most of any variation in pump pressure is absorbed in the drill pipe rather than in the annulus.

We want to control a kick in something other than haphazard fashion. To do this, we must know the conditions in either the drill pipe or annulus at all times. With reverse circulation and our present methods for determining the initial rate and period of inflow of formation fluids, this is impossible. We can make some fairly close approximations, but without actual field trial, we cannot say whether they would be close enough.

As soon as reverse circulation begins, the mud in both the drill pipe and annulus is cut by the foreign fluid. From this point on, it would be quite difficult to determine the pressures that should be maintained at the surface to properly control the bottom-hole pressure. Although we might eventually reduce annulus pressure to the initial drill-pipe pressure, we have no means of determining conditions in the drill pipe. This is true because the height filled by the cut mud inside the drill pipe is considerably different from that which it filled in the annular space.

There is a second effect that could result from the difference in area of the annular space and drill pipe. Suppose a fairly large volume (100 to 200 bbl.) of mud were gained. The entire drill pipe could become filled with formation fluid. Pressures almost equal to formation pressure would have to be contained by surface equipment.

To be able to reverse circulation at all, we would have to run a sub which could be opened with large-circulating ports just above the bit. Such a sub would necessarily be a limber section of the drill-collar string. It would be weak compared to normal subs or drill collars.

Regardless of the size ports used in the sub, they could become at least partially plugged. In this event, more pressure would be put on the annulus, thus increasing the possibility of a formation breakdown up the hole. Complete plugging would almost certainly cause formation breakdown. Further, should plugging occur, circulation in the normal direction probably would be impossible because the bit jets would likely plug up with formation chips which entered the drill pipe through the sub ports.

Therefore, with present equipment and know-how, reverse circulation has far more disadvantages and hazards than advantages.

TABLE 3—MUD REQUIRED TO CONTROL WELL WITH PIPE AT DEPTH SHOWN
(Pipe pulled from 15,000-10,000 ft. and returned to depths shown)

Depth (ft.)	Mud weight required at per cent volume swabbed*				
	5%	10%	25%	50%	100%
10,000	15.4	15.8	16.9	18.8	22.5
11,000	15.4	15.7	16.7	18.4	20.5
12,000	15.3	15.6	16.6	18.1	18.7
13,000	15.3	15.6	16.5	17.2	17.2
14,000	15.3	15.5	16.1	16.1	16.1
15,000	15.0	15.0	15.0	15.0	15.0
Mud pressure lost, psi.†	200	400	1,000	2,000	4,000

*Assumed foreign fluid has no appreciable density. †Rounded to nearest 100 psi.

TABLE 4—STRENGTH OF DRILL PIPE AND DRILL TUBING IN PSI.

Drill pipe (o.d., in.)	Weight (lb./ft.)	Grade	Burst	Collapse	Tensile
2⅜	4.70	N-80	11,200	9,380	104,340
	4.85	E	10,580	8,830	97,820
	6.65	D	11,350	10,140	101,000
	6.65	E	15,470	12,480	138,000
2⅞	6.50	N-80	10,570	8,900	144,960
	6.85	E	9,980	8,830	135,900
	10.40	D	12,120	10,730	157,000
	10.40	E	16,530	13,210	214,000
3½	9.30	N-80	10,160	8,580	207,220
	9.50	E	9,600	8,080	194,270
	13.30	D	10,120	9,170	199,000
	13.30	E	12,350	11,290	272,000
4	11.00	N-80	9,170	7,520	246,140
	11.85	E	8,660	7,080	230,760
	14.00	D	7,940	7,380	209,000
	14.00	E	10,830	9,090	285,000
4½	12.75	N-80	8,440	6,680	288,040
	13.75	E	7,900	6,290	270,030
	16.60	D	7,210	6,760	242,000
	16.60	E	9,830	8,310	331,000
5	15.00	E	7,830	6,140	328,070
	19.50	D	6,960	6,550	290,000
	19.50	E	9,500	8,060	390,000

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3. "Composition and Properties of Oil-Well Drilling Fluids," by W. F. Rogers, 254, Gulf Publishing Co., Houston, second edition.

ANOTHER HOMCO
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SUCCESS REPORT

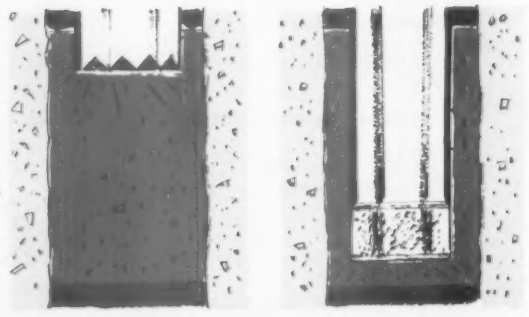
Saved 29 days on 3 recent fishing jobs.

A North Texas
Driller Reports:

"OUR 'KLUSTRITE' ROTARY SHOE SPLIT A DRILL COLLAR IN RECORD TIME."

"We stuck a 3' change over sub (6" OD — 2½" ID) and a 6" by 29½' drill collar under the surface pipe. Sub and collar were partly imbedded in the side wall beneath surface pipe. *Using three 'Klustrite' rotary shoes, the sub and drill collar were split longitudinally.* The bore I D of the collar was bisected, so that half of the collar was left in the side wall, the other half was brought out of the hole. The hole was then opened to full diameter and normal operations resumed. *Using 'Klustrite' shoes this job required only three days. Ten to twelve days is the normal requirement when using conventional mild steel rotary shoes."*

An Operator In
Oil Center, N.M., Reports:



"THE 'KLUSTRITE' SHOE WE USED PENETRATED 20 TIMES FASTER THAN A CONVENTIONAL ROTARY SHOE."

"We used a 'Klustrite' flush bottom shoe to wash-over a holddown packer in an open hole well. We had previously run a conventional hard metal shoe, but were able to penetrate only 3" in 39 hours. *Homco's 'Klustrite' shoe had made 18" in 12 hours when packer started moving down hole.* Packer was followed to TD and was recovered in the washpipe. Shoe was in near perfect condition when job was completed."

LOOKING FOR THE BEST IN FISHING AND CUTTING EQUIPMENT?

HOMCO HAS IT!

This is the kind of performance you can expect from HOMCO "KLUSTRITE"® MILLING PRODUCTS... in any area... under any condition!

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From Cameron Parish, Louisiana, A Driller Reports:

"WE MILLED-UP 65' OF CASING IN 8½ HOURS."

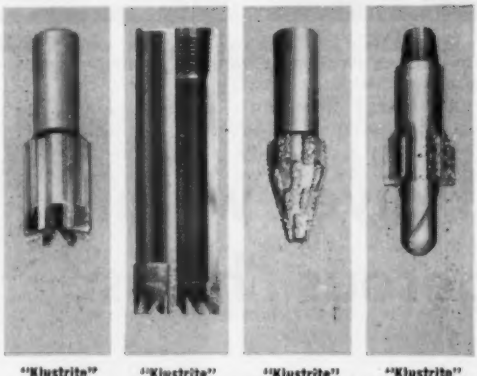
"After three unsuccessful attempts to recover a 5" liner, we decided to mill-up the casing. Using a Homco 'Klustrite' multi-blade pilot mill, we milled-up at 65' of 5" N80 casing from a depth of 9700 to 9765'. Pilot mill was turning at 100-125 rpm with a weight ranging from 15,000-18,000 lbs. *Casing was milled-up at a rate of 7¾' per hour.*"

The most outstanding development in washover and cutting equipment is HOMCO "KLUSTRITE."

"Klustrite" rotary shoes, mills, and reamers have the best all around cutting ability in the industry—have an infinite number of cutting edges on the treated areas. When one edge dulls another takes over. The cutting efficiency of the tool is constant.

To achieve these distinct advantages, the unique "Klustrite" process uses carbide slugs fractured into jagged fragments (about ⅛" to ¼" in cross section). The slugs are then interspersed into a resilient matrix on the tool. The small carbide fragments are supported on all sides by the matrix or bonding material, which is resilient enough to allow some movement of the carbide particles under impact, thus they are able to withstand the most severe shocks without chipping or breaking.

Homco "Klustrite" washover and cutting tools are available through all Homco stores and export offices.



"Klustrite" Type "A" Junk Mill | "Klustrite" Rotary Shoe | "Klustrite" Type "C" Tapered Mill | "Klustrite" Type "CL" Pilot Mill

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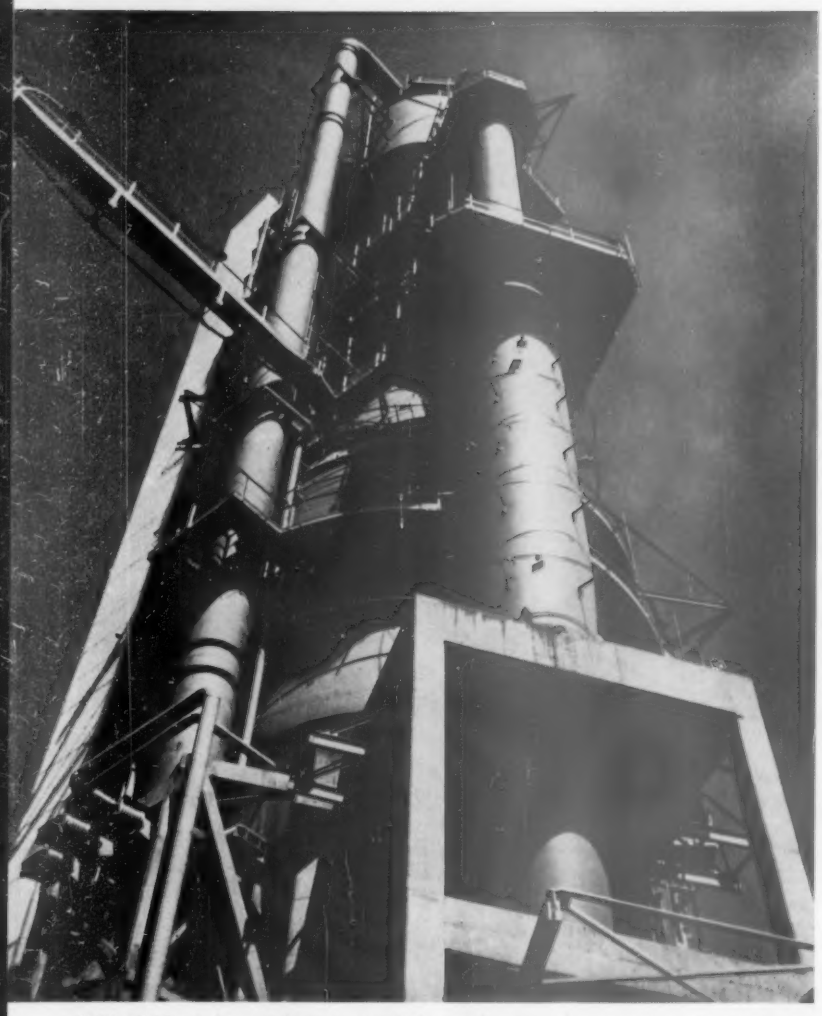


ANY PART of this cracking unit which can be seen from a distance can be inspected from a distance. With temperature-indicating paint, a hot spot shows up at a glance.

Paint gives warning of dangerous "hot spots"

Temperature-indicating paints provide refiners with a built-in DEW (distant early warning) system

BY W. F. CONNORS
Humble Oil & Refining Co.

"HOT SPOTS" in refinery equipment can cause production down time—unless they are caught early. At Humble Oil & Refining Co.'s Baytown refinery, early warning of trouble is provided by silicone-based temperature-indicating paints—paints that change color when the surface gets too hot. These paints are used on catalytic crackers, reformer reactors, pressure vessels, flue-gas collectors, and heat exchangers.

"Hot spots" are produced on the outer shell of internally insulated process equipment when the insulation cracks or wears thin. Such spots can overstress the shell and cause steel fatigue.

As applied, these new paints for indicating high temperature look like any other good paint. They come in attractive shades of blue or green and hold these colors for months, even years, at 250° or 400° F. But let the temperature of the surface rise above a certain design temperature (575° F. in the case of one paint) and the painted surface will irreversibly change color within 45 minutes. Thus the paint serves as a "recording thermometer" to warn of a developing hot spot.

As "recording thermometers," temperature-indicating paints give advantages unattainable with any other system. They can cover every square inch of the surface of an internally insulated unit, even in areas that are inaccessible when the unit is operating. Considering labor cost, they cost little more than any other good paint job. And they give an early warning of impending trouble.

Importance of Early Warning

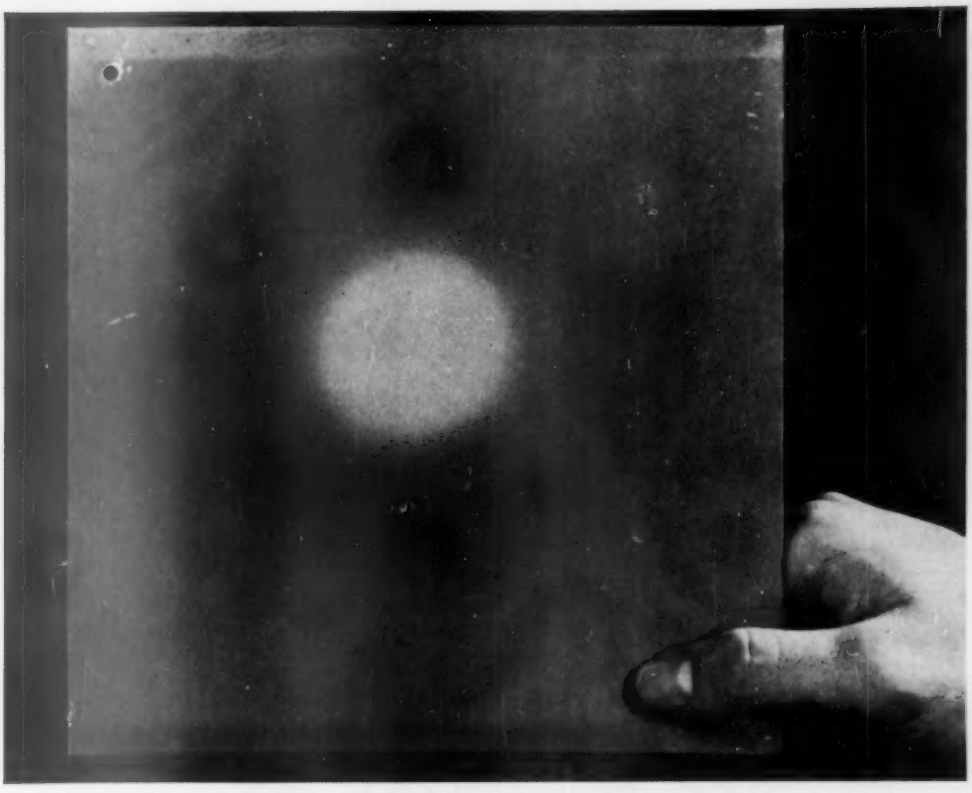
This early warning is important. If the insulating lining has failed to the point that it produces a large hot spot on the shell of the equipment, the unit may have to be shut down immediately for repairs, since heat can weaken the steel shell. An emergency shutdown of this kind almost always means a snarl in production and greatly increases production cost.

But if the overheating spot can be caught early, a low-pressure-steam line can be rigged to cool the spot. The unit can then continue in production until a shutdown can be scheduled.

Temperature-indicating paints do an excellent job of showing the exact outlines of the "hot spot" regardless of its location. An evaluation of the seriousness of the situation can be made immediately.

These paints have proven so effective as a hot-spot indicator that low-carbon steel is suitable for use on certain hydrogen-handling equipment where alloy steel is commonly used. The early warning given by the temperature-indicating paint makes it practical to use the less expensive material.

The new temperature-indicating paints are no more costly than other modified silicone paints regularly used in hot surface applications in Humble's Baytown refinery. For this reason, they are used on some hot surfaces where their temperature-indicating property is not needed, simply because their use fits in well with the color scheme of the unit.



PAINT PANEL. Bunsen-burner flame produced this "recorded hot spot" on a steel test panel. Although the paint has changed color irreversibly, the paint film remains intact.

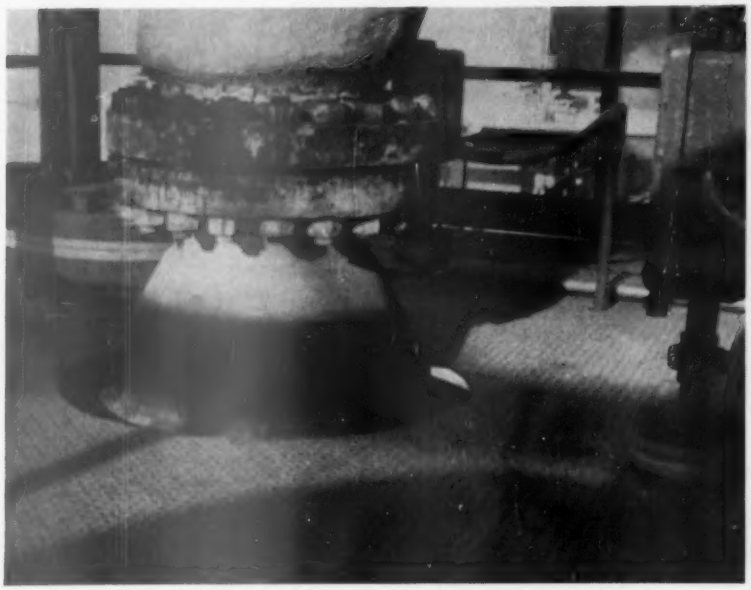
These paints are manufactured by Humble's special-products plant from modified silicone and acrylic resin combinations, and indicate a single temperature transition. These are:

1. A royal blue which changes to a chalk white at 585° F;
2. A light blue which changes to a white, also at 585° F; and
3. A light green which changes to white at 750° F.

In these modified silicone paints, the silicone resins impart excellent heat stability and weather resistance while the modification enables them to form a hard film without the need of a high-temperature cure. Straight silicone resins require a heat cure in order to obtain full hardness.

Surface preparation for temperature-indicating paints does not differ from accepted practices for such equipment. Sandblasting is preferred but thorough wire brushing is acceptable. These paints, which may be sprayed, are dry to the touch in about a half hour and can be given a second coat in about 4 hours.

All in all, the paints do an excellent job. They will serve effectively as colored maintenance paints for many months, or even years, preventing corrosion and maintenance paints for many months, or even years, preventing corrosion and maintaining their original bright colors. Yet when temperatures rise to the danger point, they give an unmistakable warning in a matter of minutes—a warning that can be easily read at a distance by every worker, foreman, executive, or maintenance man.



TEMPERATURE-INDICATING paint gave quick warning of insulation failure on this line. If overheating can be caught early, a low-pressure steam line can be rigged to cool the spot.

How can force application be made efficient?

BY JOSEPH ZABA

PUMPING-UNIT geometry and direction of crank rotation affect the way force is applied to the walking beam. This in turn affects the efficiency of the surface part of the sucker-rod pumping system.

Pitman pull. In a conventional beam setup the tail bearing is above the samson-post bearing and is not in the horizontal line with it for the horizontal position of the beam. The direction of the force, applied through the pitman, Fig. 4, varies from the true right-angle pull on the lever arm of the walking beam. The right-angle pull is the most efficient method of force application since all of the force is used in performing work.

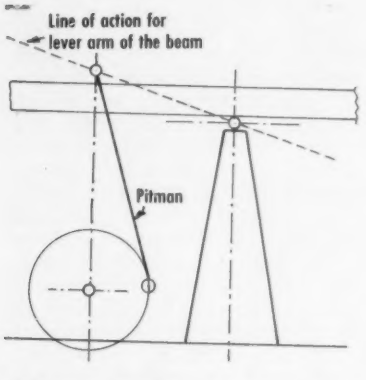
In case of deviation from the vertical pull, the pulling force is divided into two components, Fig. 5. Of the two, only the one perpendicular to the lever arm of the beam performs the actual work. The component parallel to the lever arm sets up stresses in the pumping structure.

Results of these conditions are shown in Fig. 6. Magnitude of the component of the pull parallel to the lever arm of the beam is shown for different crank positions. Since this component of the pitman pull does not contribute to the actual work of lifting fluid, its magnitude is a measure of efficiency of the use of force acting through the pitman.

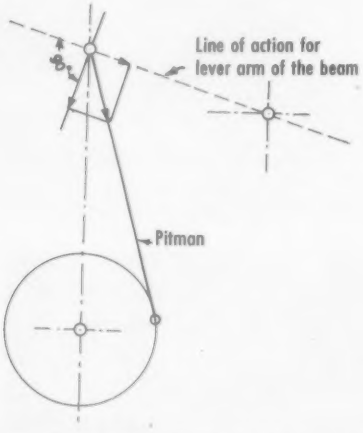
Fig. 6 has been prepared for an assumed beam and pitman assembly as shown in Fig. 4, with a fixed set of dimensions. The curve shows that the component parallel to the lever arm of the beam reaches a maximum during the upstroke, with peak during the downstroke being smaller. This means that during the upstroke, which is the actual working part of the pumping cycle, with the deviation from the right-angle pull at a maximum, the pitman pull efficiency is at a minimum. True right-angle pull is attained at two points at which the component parallel to the lever arm of the beam equals zero. Several arrangements are used, both in manner of operation and in design of pumping units, to improve efficiency of the pitman pull during the upstroke.

Counterclockwise rotation. Clockwise rotation of a pumping unit occurs when the crank moves toward the well from its top vertical position. Closer study of Fig. 4 suggests that there should be less deviation from the true right-angle pull during the upstroke when the crank rotates counterclockwise. This is shown by the curve in Fig. 6. For counterclockwise rotation this curve has to be read from right

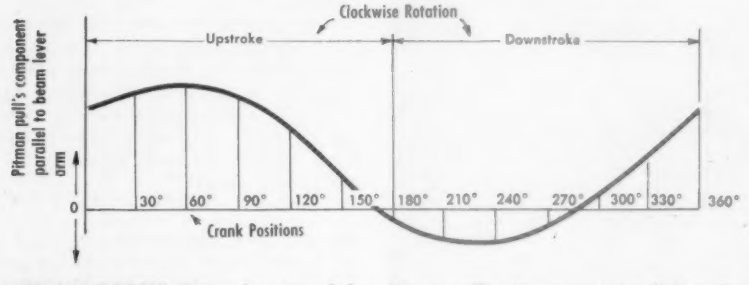
(Continued on page 125)



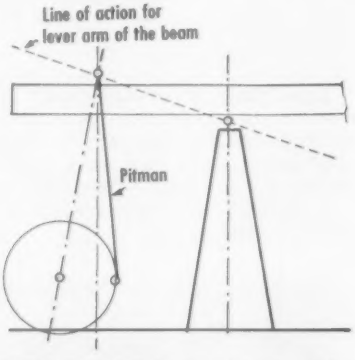
LINE OF ACTION for the lever arm of the beam is not horizontal for a horizontal beam position in a conventional unit. Fig. 4.



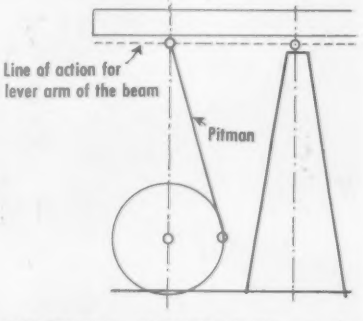
FORCE DIAGRAM showing the components of the pitman pull. Fig. 5.



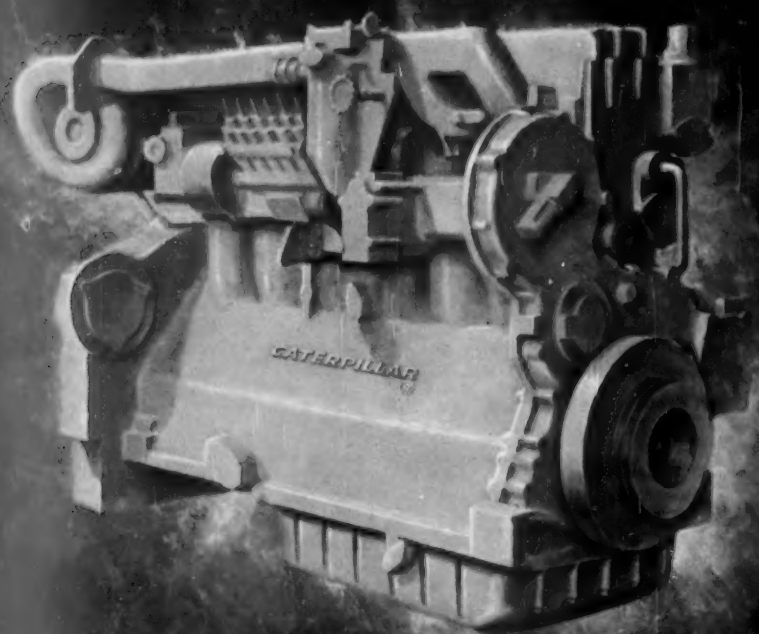
THIS WAVE FORM shows the size of the pitman pull's component parallel to the beam lever arm. Fig. 6.



WHEN THE CRANK is set back of the vertical line through the saddle bearing, the pitman pull's component parallel to the lever arm of the beam is reduced. Fig. 7.

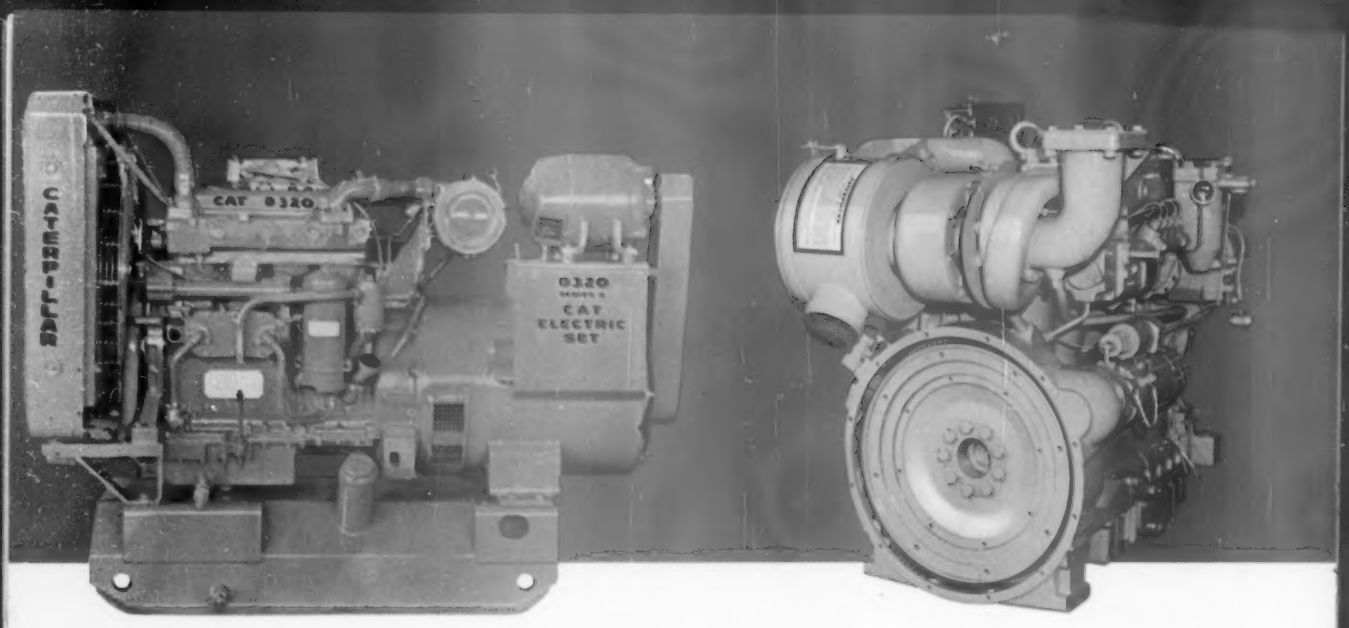


CENTER-LINE ARRANGEMENT of the crank with the saddle bearing below the beam. Fig. 8.



NEW COMPACT DIESELS
BY CATERPILLAR

Caterpillar announces a new line of four-cycle diesels that sharply reduces physical dimensions and weight-to-horsepower ratio. Features of durability, fuel economy and dependability, long associated with Caterpillar four-cycle diesels, are still apparent.



D320...130 HP
(Shown as Electric Set*)

D330...180 HP
(Shown as Industrial Engine*)

NEW FROM CATERPILLAR—HIGH OUTPUT, LIGHTWEIGHT, COMPACT DIESEL ENGINES

Since introduction of the first mobile diesel engine in 1931 Caterpillar engineers have been testing materials and methods to reduce diesel size and weight and at the same time develop more horsepower. Three products of this program are the new D320, D330 and D333. Their size, performance and price now offer significant and increased economic return to the user.

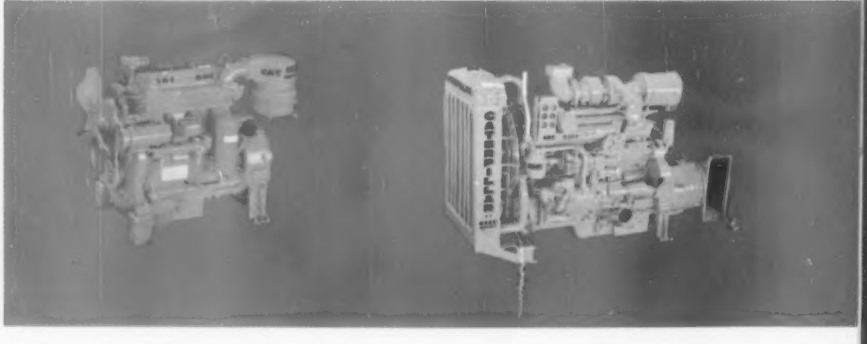
Now you can get premium four-cycle performance . . . and what is very important to you . . . at no premium in price.

These engines and the rest of the Cat Diesel line are designed for your job or manufacturers' equipment whether it be industrial, electric power generation or marine.

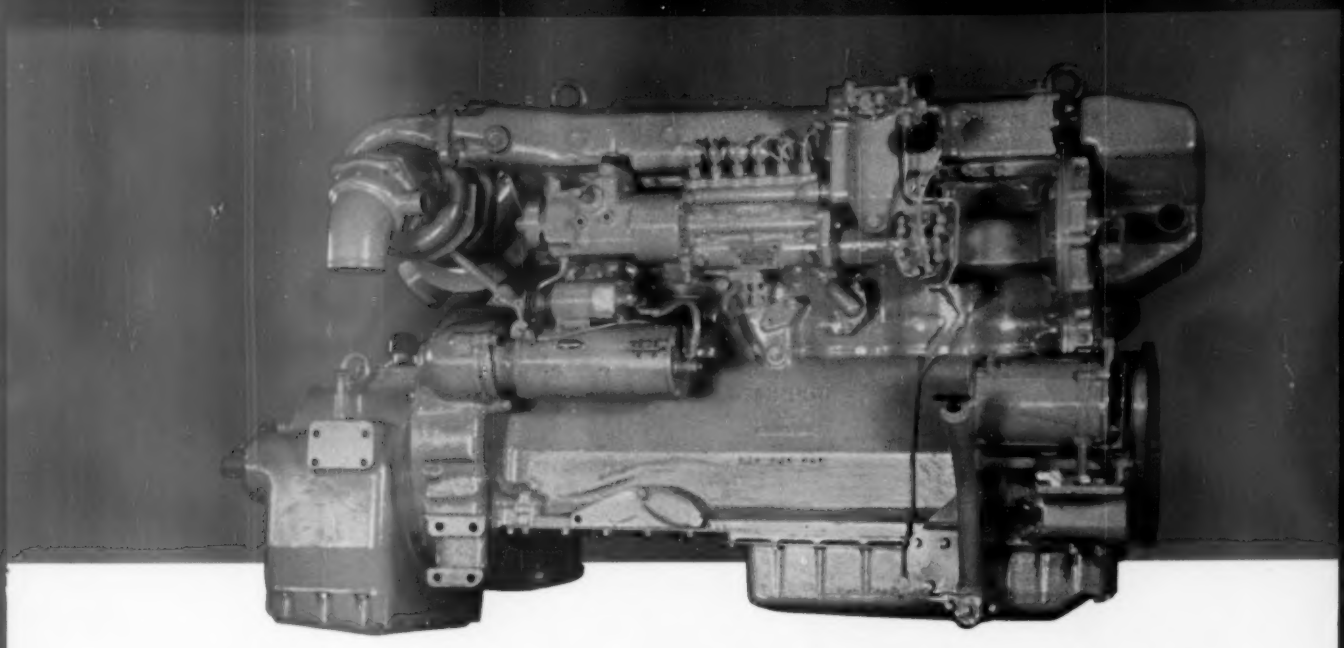
Shown below are more models. Space prevents the illustration of Caterpillar's complete line running to hundreds of configurations.

D311H POWER UNIT

D337 EXCAVATOR MODEL



Caterpillar manufactures a full line of diesel and natural gas engines. Diesels range in horsepower up to 730; output of the largest electric set is 400 KW. Diesels are available in industrial, electric set and marine versions. Caterpillar also manufactures the lowest cost per horsepower natural gas engine on the market today. Hundreds of thousands of Cat Diesel predecessors to the new series have set performance and economy records, the world over.



D333 . . . 270 HP
(Shown as Marine Engine*)

*All available in industrial, electric set, or marine configurations. These are maximum usable horsepower ratings with 85° water to aftercooler.

GOOD SERVICE LIFE Valve rotators insure perfect valve seating, give extended valve life. Turbocharging helps keep valve temperature lower. Pistons are spray cooled from underneath and cylinder liners are full length, wet type for better heat transfer. These features and many others such as elliptically shaped pistons and shot peened, fatigue-resistant crankshafts make this series dependable performers.

SMOOTH AND QUIET RUNNING All of these engines are smooth running. The four-cylinder D320 and D330 have built-in balancers that remove the roughness characteristic in four-cylinder engines. Turbocharging muffles exhaust noises to a point where mechanical muffling or insulation is not often needed.

ECONOMICAL These engines have a precombustion chamber injection system design which is non-sensitive and lets the engine digest lower-cost, heavier, higher-heat-content fuel. Being able to burn fuel such as commonly available household furnace oil compared to gasoline or premium diesel can save many thousands of dollars in fuel costs over the life of the engine.

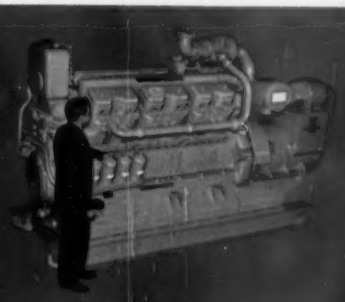
DEPENDABLE These engines can idle for extended periods, then accelerate to full load and speed with a clean, clear exhaust. This ability to burn fuel completely over a full range of speed and load is the result of four-cycle design plus the use of a precombustion chamber injection system. It results ..o in better part load fuel economy.

POWERFUL The specification sheet horsepower is the horsepower you can use. There is no need for derating with a Cat Diesel. In fact, you can request and get a formal horsepower certification with each engine you purchase.

D342 MARINE

G375 NATURAL GAS

D397 ELECTRIC SET



Completed in 1959, the new Mossville, Illinois, Industrial Engine Plant manufactures Cat Engines on a mass-production basis.

Partially complete, Caterpillar's new Technical Center provides an appropriate research atmosphere and ultra-modern facilities. Two of these buildings are devoted to prime power research.

Basic in-line Diesel and Natural Gas Engines are also machined and assembled in this modern Peoria, Illinois, plant, completed in 1948. Another large plant (San Leandro, Calif.) manufactures fuel injection components.

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Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

engine power
BY CATERPILLAR

Printed in U.S.A.

OIL-WELL PUMPING

(Continued from page 120)

to left. Therefore, the peak deviation from the right-angle pull occurs during the downstroke.

This is true for the arrangement of the unit as shown, that is, with pitman bearing above the beam and with center of the crank vertically under the bearing with the beam horizontal. It is not necessarily true for other arrangements.

Crank setback. An arrangement of the unit for reducing the deviation from the right-angle pull of the pitman is setting back the crank, Fig. 7. The position of setback may vary. From Fig. 7 it is apparent that there should be less difference in deviation from the right-angle pull between the upstroke and the downstroke than in the arrangement of Fig. 4. If a curve similar to that shown in Fig. 6 were prepared for the crank setback it would show this to be the case. Thus, for this arrangement, there should be little difference from the standpoint of right-angle pull between clockwise and counterclockwise rotation.

Centerline arrangement. Fig. 8 diagrams a pumping-unit layout in which the pitman stirrup bearing and the samson bearing are in a horizontal line for a horizontal beam. Center of the crank is vertically under the pitman bearing. As in the case of crank setback there should be little difference between the degree of deviation from the right-angle pull during the upstroke and the downstroke or between clockwise and counterclockwise rotation.

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1. W. C. Shutts and Bowman Thomas, "Efficient Operation of Pumping Rigs": proceedings first midyear meeting, API Division of Production, Production Bulletin 207-1931.

2. Bay Hopper, "Efficiency and Load Tests on Well-Pumping Units": Petroleum Engineer, January 1940.

BOOKS

ELEMENTARY MATHEMATICS OF LINEAR PROGRAMING AND GAME THEORY. By Edward G. Bennion. Published by Bureau of Business and Economic Research, College of Business and Public Service, Michigan State University, East Lansing. 140 pp. $5.

This book is written for the reader who wishes to learn the rationale underlying linear programing and game theory. The author has designed his book to meet the needs of the mathematically unsophisticated reader by limiting the scope of his discussion to fundamental concepts.

While a knowledge of college algebra is essential and an acquaintance with analytical geometry desirable, the most important requirements for studying the exposition are sufficient motivation and staying power.

Beginning with a general declaration of objective and content, the author goes on to visualize elementary concepts, and discuss the Simplex method, degeneracy and other difficulties. He treats quality, game theory, the relation of game theory with their duality and their solution. One chapter deals with linear programing as games, and ends with an over-all discussion of linear programing, game theory, and economics.

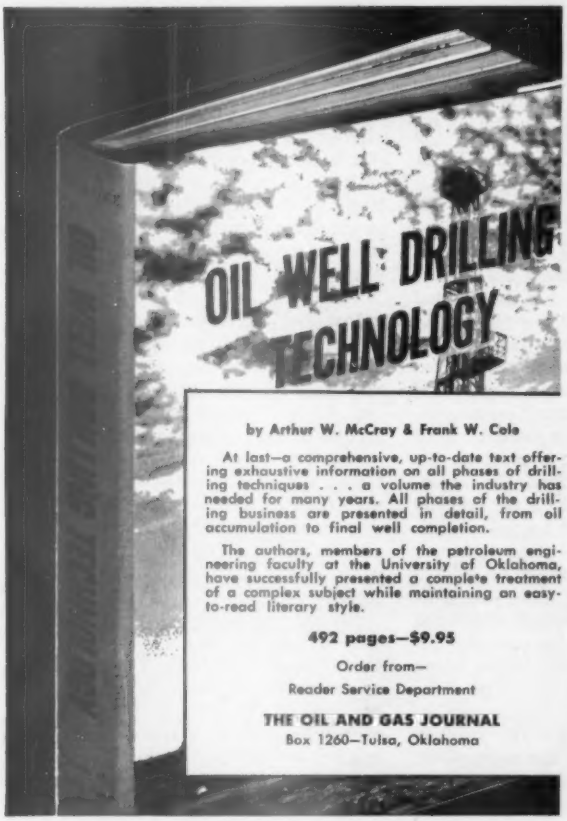
ELEMENTS OF CRYSTALLOGRAPHY AND MINERALOGY. By F. Alton Wade and Richard B. Mattox. Published by Harper & Bros., 49 East Thirty-third Street, New York 16. 331 pp. $7.50.

This book introduces the beginner to the dynamism of the field, while presenting him with concepts and materials that are within his grasp.

Centering on theories and principles, it begins with a review of background information on the solid state of matter. From there the authors proceed to discussions of the crystalline state, of geometrical crystallography, the classification of crystals, crystal chemistry, and the structures of the silicates. Chapters are devoted to the subjects of economic and genetic mineralogy.

The book presents over two hundred descriptions of the more common and frequently used minerals.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.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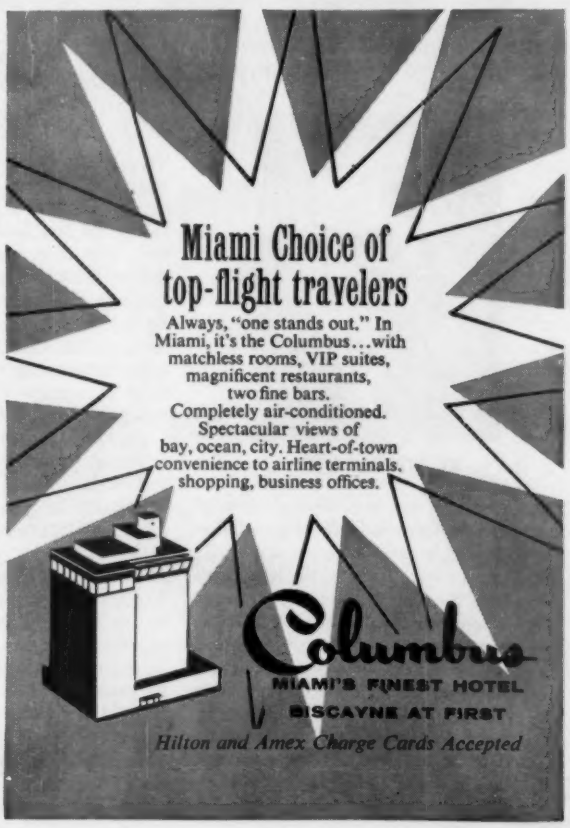
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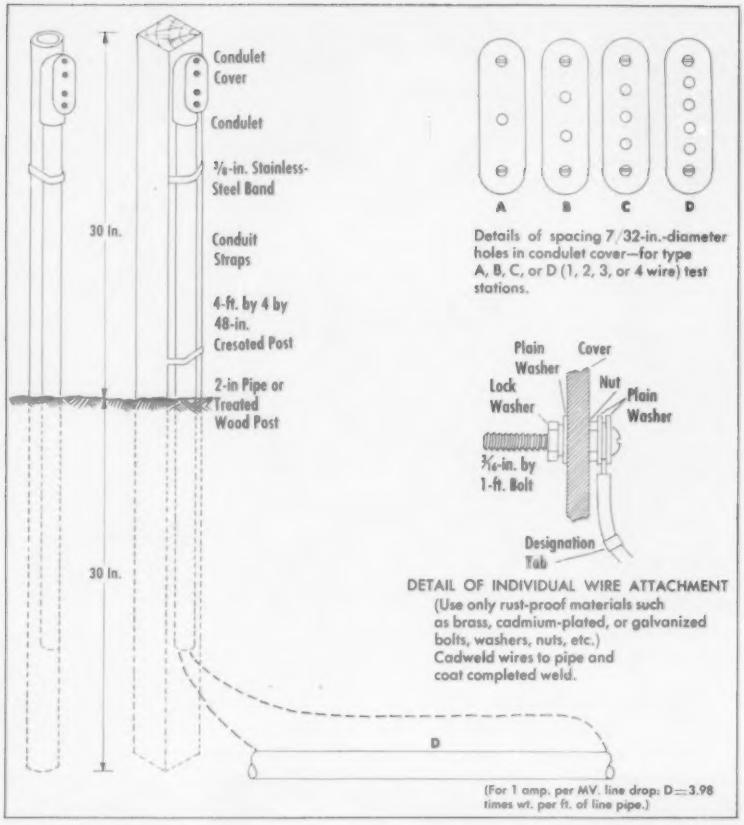
Avoiding shorts with test leads

THERE ARE several causes of shorted cased crossings of pipelines other than bends too near the crossing and sinking of the backfill (OGJ, p. 189, May 16).

Some other known causes are crooked casing, dented casing, foreign objects between the pipe and casing, and fouled test leads, not to mention improper use of insulators and seals.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Condulet
⅜-in. Stainless-Steel Band
30 In.
Conduit Straps
4-ft. by 4 by 48-in. Creosoted Post
2-in Pipe or Treated Wood Post
30 In.
D
A
B
C
D
Details of spacing 7/32-in.-diameter holes in condulet cover—for type A, B, C, or D (1, 2, 3, or 4 wire) test stations.
Plain Washer
Cover
Lock Washer
Nut
Plain Washer
⅜-in. by 1-ft. Bolt
Designation Tab
DETAIL OF INDIVIDUAL WIRE ATTACHMENT
(Use only rust-proof materials such as brass, cadmium-plated, or galvanized bolts, washers, nuts, etc.)
Cadweld wires to pipe and coat completed weld.
(For 1 amp. per MV. line drop: D=3.98 times wt. per ft. of line pipe.)

CATHODIC PROTECTION test wire station, for use of No. 12 type TW wire, Fig. 1.

BY STEVE OWENS

. . . an electrical engineering graduate from Oklahoma A&M (now Oklahoma State), is sales engineer with T. D. Williamson, Inc., Tulsa. He has been with the Bureau of Mines petroleum experiment station, Bartlesville, Okla.; the Department of Interior's Helium Division, Amarillo, Tex.; gas-production engineer and corrosion engineer with Cities Service Gas Co.; construction foreman with Huddleston Engineering Co., Bartlesville; and a sales engineer of cathodic protection supplies. His industry career spans 22 years.

Very likely there are other causes that have not yet been pinpointed.

Use of test leads. Test leads are a very important part of corrosion mitigation. Their arrangement, frequency, spacing, and number are determined by the man who will use them. As soon as backfill has settled on new construction, the test leads are used to help determine the type, kind, and amount of cathodic protection needed.

Immediately after the application of cathodic protection to a pipeline, the test leads are used to check the results. Thereafter they are used periodically in the maintenance of corrosion mitigation.

Test leads, then, should be located where they are readily accessible. This means they will be located where the pipeline crosses highways, at all-weather roads, and other points where they can be reached by automobile.

At cased crossings when two or more test leads are shorted together, the reading taken at the ends above the ground can be distrurbing. In some cases this reading can indicate the pipe is in contact with the casing. This incorrect diognosis is frequently made if one of the shorted wires is attached to the casing or if one of the other wires is grounded to the casing or the vent pipe.

Installing test leads. When test leads were first used, it was quite common to group or twist them together along the bottom of the open pipeline ditch and bring them to the top of the ground at some convenient point such as at the casing vent. After backfilling, this practice subjected them to such hazards as being caught between two rocks or between a rock and the pipe or casing. This often caused the wires to cut through insulation and contact each other.

Several satisfactory methods can be used to prevent shorts in test leads. One of these is shown in Fig. 1. Some engineers prefer plastic conduit or rubber hosing. If conduit is not used each wire may be spaced away from another in the backfill and a safe distance away from the pipe and casing until it reaches the top of the ground.

At Cities Service Oil Company's Rahway, N. J. refinery

Bitumastic Coatings outlast costly materials on tough, tide-zone piling protection

The Cities Service refinery's docking area is located on the Arthur Kill, a salt water channel with a high content of industrial wastes and debris that presents a tough corrosion problem. That's why special attention was given to the protection of sheet steel piling at the wet-dry zone.

Two types of coating systems were tried, both over sandblasted steel; one, a new type of coating using "exotic" materials, and the other, a combination of two Koppers coatings: Bitumastic® No. 50 and Bituplastic® No. 28.

Within six months, the more expensive coating was badly deteriorated, and had to be removed, while the Bitumastic coating system was still in excellent shape—and is now protecting *all* the piling. The combination of heavy-duty undercoating given by thick, tough Bitumastic No. 50 and the sunlight and water-resistance of Bituplastic No. 28 over this base was the happy answer to the specific conditions.

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In the price-economy of competitive bidding, especially in the field of capital process equipment, the historic struggle between long-range economy and "low-dollar" first-costs has been brought into sharp focus by modern cost engineering practices. Calculating and evaluating the eventual profitability of such equipment can no longer be a matter of "guestimates" or conjecture. The practical facts of economic life must be faced. Process companies must scrutinize closely ALL the factors concerned in engineering, construction, installation and **continued operation.** Unanticipated maintenance or replacement costs can quickly increase the cost of operation, and supposed first-cost savings are thus virtually or entirely eliminated.

Why is "cost engineering", or engineering economics an exotic term to most engineers? This is the Age of Specialization, and so it follows, given free rein, over-design frequently occurs. At the other extreme is the "gimmick pushers" approach that anything will suffice if the price is right. Between these two extremes the dedicated engineer must establish parameters that will satisfy to the highest degree the three M's of industry — Men, Materials, and Means.

Faced with these problems, then, how can we best solve the problem: "When is a low bid really low?" A multitude of answers must contribute to the total solution. What is the longevity of the equipment? How many spare parts will be required? How often will shut-down be required to make repairs? How much time will be required? What are the economic consequences of shutting down the continuous flow operation?

Cost-and-economy consciousness is of prime concern in each stage of process equipment manufacture — from design through fabrication, and finally to installation and operation. All aspects of true costs must be considered, not simply those which are obvious at the moment.

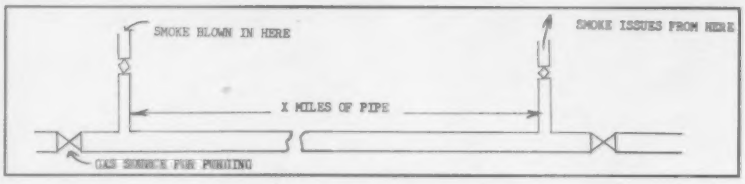
Infinite care must be exercised when considering the following:

Design — a major factor involved in the creation of process equipment. During the design phase, the greatest waste often results from a desire to be conservative. True economy in design must, therefore, satisfy the criteria which apply to each particular process.

Payout — management is interested in equipment that will pay out in the shortest period of time, and this would seem to indicate buying only what is required, at the lowest cost, at the time it is needed. Again, however, the life of the equipment, its maintenance, shut-down time and other factors cannot be ignored.

Excess-capacity — each piece of equipment must be designed for its specific use in order to obtain maximum benefit of capital dollars. Excess-capacity equipment, purchased without specific anticipation of future expansion, represents idle investment dollars.

Today's fierce competition requires the concentrated application of both short and long term economies, from design through final construction and operation. **This subject is treated in more detail in a new booklet, "Low Ultimate Costs and Low Dollar Bids Are Not the Same", and single or multiple copies are available by writing WESTERN SUPPLY COMPANY, P. O. Box 1858, TULSA, OKLAHOMA . . . where the teamwork of science, engineering, technology and economics are combined to provide the optimum in the "cost-engineered" heat exchangers in your future.**



PURGING, using the smoke method.

How to purge a gas pipeline

BY CLINTON McCLURE
El Paso Natural Gas Co.

TO PURGE pipelines of air, an excess amount of gas has been used as a safety measure.

We are still vitally concerned with safety, but we have attempted to develop a more efficient and economical means of using gas without sacrificing accuracy or reliability.

There are several methods used in pipeline purging.

Smoke Method

Several years were spent in looking for a colored gas or smoke that was not toxic or corrosive. A nontoxic, noncorrosive mine smoke is now being used for purging in the same manner as other displacement methods. (See drawing.)

A direct-current-driven blower attached to a sheet-metal flume is placed on top of the upstream blowoff. The smoke candle is placed in a filtered pipe capsule attached to the side of the flume. Before placing the flume over the blowoff, the candle fuse is lit, the safety cap is screwed on, and the blower is started.

The smoke from the candle is emitted to the flume and the blower forces it into the blowoff. If too much suction is present at the injection point, the downstream blowoff should be closed during injection.

The downstream blowoff may be observed from a convenient distance. The smoke may be seen coming from this blowoff. After the smoke has cleared for 1 minute, the blowoff may be closed for loading the line.

It is not certain whether the smoke may be seen at night with the aid of a spotlight. This is the only anticipated weakness of this system. This method requires only the amount of natural gas to insure complete safety.

Experience Method

The most common practice might be called an "experience" method. A large amount of gas is blown through the pipeline until the pressure drop through the downstream blowoff is sufficient to cause water-vapor "nodes" above the blowoff. A time element is also used in conjunction with this type of purging.

The white cones or "nodes" of cones are condensation of water vapor in the atmosphere caused by the pressure drop and resultant cooling. One bad feature of this method of purging, in addition to gas waste, is loss of timing.

Inert-Gas Method

Another method of purging is filling the chamber of pipe with inert gas. The gravity of the inert gas is different from that of natural gas. A gravity meter of some type is used to check the specific gravity until the meter indicates the gravity of natural gas and the blow is closed in.

The gravity meter is also used without the inert gas. This is about as risky and expensive as the "experience" method.

Other Methods

Still another method is to fill the chamber of pipe with gas to about 50 psig. It is then bled down and shut in again. Only 50% of the total now can be air. Another 50 psig. is introduced and bled down. Now only 25% of it can be air at this stage. This is continued until personnel are sure that the safe region has been reached. This is costly in time and risky from the standpoint of the air-gas concentration points.

Several years ago I was charged with the responsibility of finding a safe, sure, inexpensive method of

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067

purging a pipeline. Unfamiliarity with the flow pattern of gas or air in a pipeline, while purging, led to some interesting experiences. At first, much of the work was done on the sly to avoid embarrassment.

The general idea was to place some type of material in the upstream blowoff and hope that it would be forced down the pipe to and out of the downstream blowoff. This would be a measure of the complete displacement of the air and of gas in the section.

The first try was with a 10-lb. sack of wheat flour which we hoped to see fog out of the downstream blowoff. This was placed in the upstream blowoff unknown to the superintendent. Of course, all of the flour stuck to the pipe wall and did not make an appearance downstream.

The next secret run was made with two dozen small rubber balloons. None appeared at the downstream blowoff. We analyzed this failure as being caused by balloon rupture.

We were so sure that ping pong balls would stand the test that we requisitioned 144 of them through normal channels. The only difference in this case was that we were able to open the downstream main-line valve in addition to the blowoff and the balls were blown out of the end of the pipe.

In the case of any solids that made the journey, they were being trapped between the blowoff and the main-line valve.

Anhydrous ammonia was being used as a tracer in flow-measurement studies. It was used in the same manner as the flour, the balloons, and the ping pong balls. A pickup point at the downstream blowoff was used. The receiver used a phenolphthalein solution for chemical detection.

This appeared to be the ideal solution; more than 30 sections of new 30-in. pipe were purged in this manner. We then returned to the operating company with our new device. Our first section of operating pipe was coated with iron sulfide. With the normal strong blow came the iron sulfide in large enough quantities to plug the pickup.

The next section tested had been pigged with water and the wet wall absorbed the anhydrous ammonia forming ammonium hydroxide making detection impossible. These two weaknesses plus the unpleasant task of standing beneath a vibrating blowoff (some valve operators believe the harder the line is blown, the better the purge) discouraged further use in this application.

Acknowledgment

The above material was adapted from a paper presented to the AGA 1960 Operating Section Conference, New Orleans.

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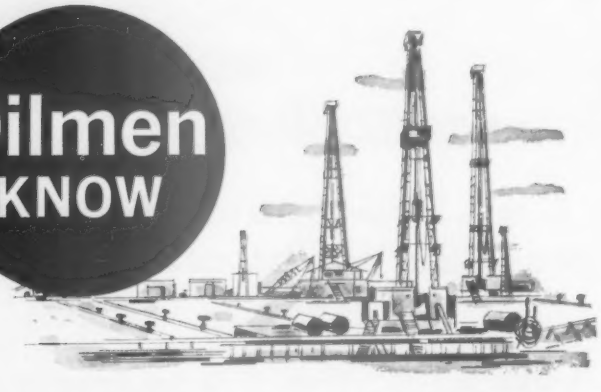

As salt-water well tubing, as salt-water gathering and disposal lines, as oil flow lines . . . Western ABS semi-rigid plastic pipe is without equal in the oil fields!

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Effortless to carry . . . quickly jointed, two men can lay several thousand feet of ABS pipe in a single day. Easily sawed, drilled or threaded, it is permanently solvent-welded in seconds. Ready-to-use ABS pipe fittings require only the simplest tools.

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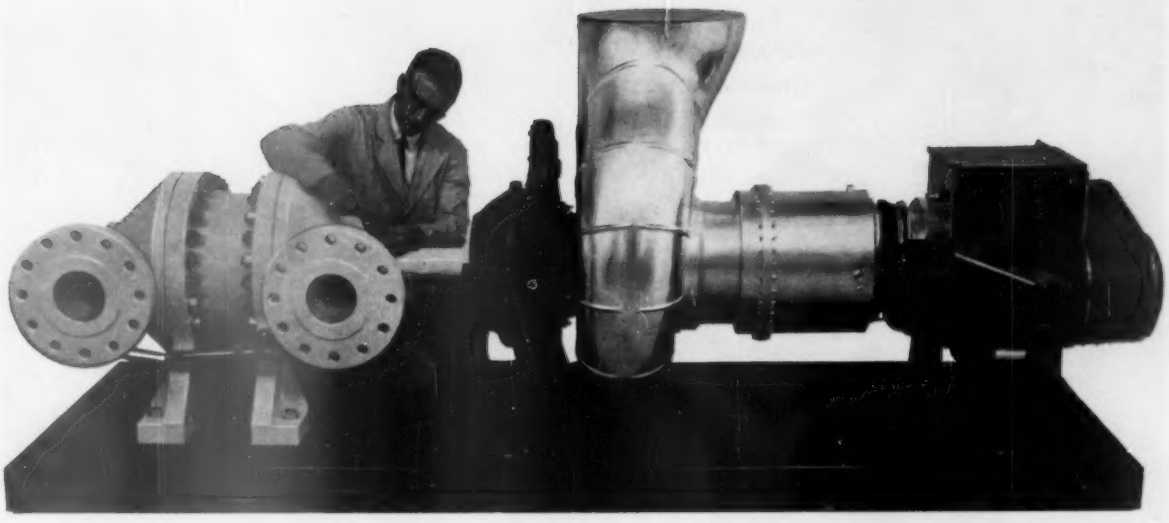


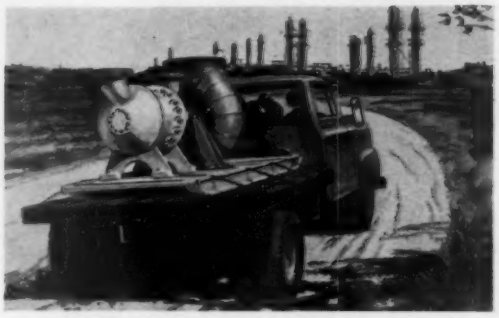
New Solar gas turbine compressor offers low cost, reliability, easy maintenance

A FUNDAMENTAL ADVANCE in the centrifugal compressor field is available in Solar's new gas-turbine-driven compressor line. These units are particularly adapted for gas compression (both field and main pipeline) and for general industrial use in the low volume range up to 1500 psi.

Long-life gas turbine engines, with rotating speeds of 15,000 to 30,000 rpm, made this breakthrough possible. Driving the compressor directly at turbine speeds has permitted the design of small, high efficiency centrifugal compressors that operate in the range from 75 to 1500 cfm or 5 to 150 MM SCFD.

Features of these compressor packages include: Interchangeable compressor rotors and other parts that allow fast, low cost field changes to meet new flow and pressure requirements. Designed to start and stop in seconds, even by remote control, they are ideal for unattended operation. Small and lightweight, they are easily moved and installed on inexpensive foundations. Maintenance is unusually simple.

Detailed information on Solar centrifugal gas turbine compressors is available. Write to Dept. H-133, Solar Aircraft Company, San Diego 12, California.



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Lufkin "Atlas" Gaging Tape (above, left) is easy to read with durable, jet-black markings on glare-free, chrome-white line. Extra *sturdy* line, 50% heavier than standard weight. 20-ounce plumb bob. Lock-handle frame.

Lufkin Chrome Clad Anchor Tape (above, right) is available with easy-to-read markings in feet, tenths and hundredths, in genuine-leather, hand-stitched case. The handiest thing you can carry, on job after job.

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Measure for measure, the finest made...

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This week's SHOWCASE features . . .

New shock trap

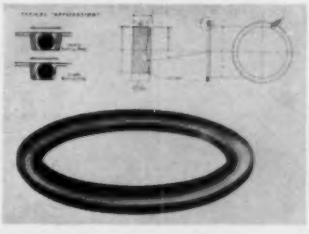
. . . for water lines is available. It is of the water-gas interface type and uses the swirl principle to reduce surge and eliminate water hammer. It absorbs shock and surge by compressing gas within the chamber and by friction through a swirl chamber. Built for design pressures to 200 psig. and up, it comes in diameters from 34 to 102 in. Source: **Pulsation Controls Corp., Box 169, Santa Paula, Calif.**

Pulsation dampener

. . . developed for small and medium-size reciprocating pumps, the Type BLS-25F, has a volumetric capacity of 420 cu. in. and weighs 115 lb. Its synthetic rubber bladder is in a non-stressed condition when it is charged with nitrogen. A number of different-sized flange connections are available. The housing is made of cast-alloy steel. Source: **Ball Mfg. Co., Inc., Box 2275, Torrance, Calif.**

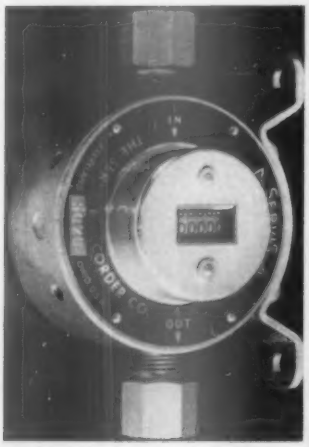
Sand pump

. . . for slim-hole wells has a 2-in. o.d. and is designed for 2⅞-in. completions. Built with a machined-lug type of bottom, the pump comes in lengths from 20 to 24 ft. It is designed exactly the same as the maker's larger sand pumps. Source: **Miller Sand Pump Co., Box 4516, Oklahoma City.**



Backup rings

. . . extend O-ring life and increase seal effectiveness, the maker reports. Designed for O-ring in-groove installations, the rings are quickly and easily installed. Called Parbaks, they are designed with a concave shape to prevent O-ring extrusion and increase lubrication of the O-ring. Source: **Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif.**



Lube-oil use recorded

. . . automatically with the Model A meter designed to be mounted on compressors of all types. It gives a continuous check of the makeup oil used by compressors. Thus operators can find out if a compressor is not getting enough oil or if it is using an excessive amount and needs inspection to prevent damage. The meter will function on both gravity-fed and pressure-fed lubricating systems. Source: **Service Recorder Co., 1013 Rockwell Ave., Cleveland 14.**

Want more facts about equipment or copies of product literature described in this issue?

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Described in OIL and GAS **JOURNAL** · Issue of **July 4, 1960**

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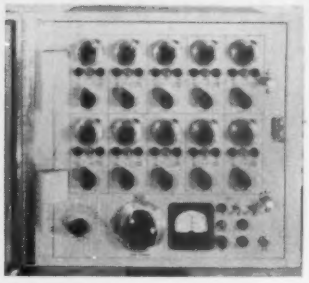
SHOWCASE . . .

New Equipment



Ten-point temperature controller

. . . called the Electro-Tech, offers three modes of operation that can be individually selected for each of the 10 controlled points—set-point, adiabatic, and offset adiabatic modes. Each point has a slave potentiometer, three indicator lights, and a selector switch. The master potentiometer has a range switch adjustable in 100° F. intervals from 0° to 1,200° F. and a vernier adjustable from 0° to 100° F. in 1° F. intervals. Source: **Electro-Technical Labs., Box 13243, Houston.**

Coated plug

. . . stops valve freezing according to the maker of a new line of polyethylene-coated plugs for use with Saran-lined plug valves. The plugs eliminate the freezing that sometimes occurs when Saran plugs are used with Saran-lined pipe. The plugs are available in eight sizes from 1 to 6 in. Source: **Saran Lined Pipe Co., Ferndale, Mich.**

●

Two-wire pump

. . . valve control called Varelectric is a newly developed supervisory control system that provides direct, instantaneous control of pump motors, valve operators, and similar equipment. It continually supervises and indicates the status of the controlled device and uses only one wire between each control and field unit, and one conductor common to many units. The system promises to cut field wiring costs to as little as 25 to 15% of that of conventional systems, which often require from seven to nine wires between individual units. Source: **Vapor Recovery Systems Co., 2820 N. Alameda St., Compton, Calif.**

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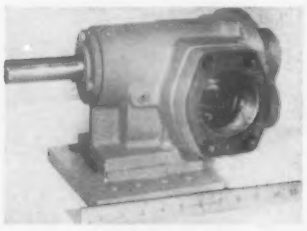

Pumps promise

. . . high efficiency from 87 to 90% mechanical and 77 to 82% over-all efficiency, and are designed specifically for gathering, transfer, injection, and power applications in oil-field service. Made in two series, the rotary type of pumps have replaceable threaded pipe flanges to fit 1, 2, 3, or 4-in. pipe on the same inlet and outlet ports. Replaceable wear plates protect the rotating elements. The Series 300 pump has helical gears and comes in

For blending crude oil products . . .

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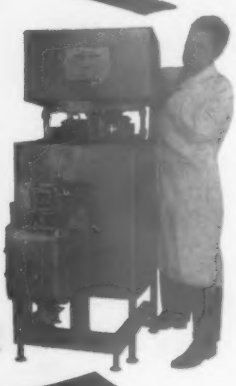

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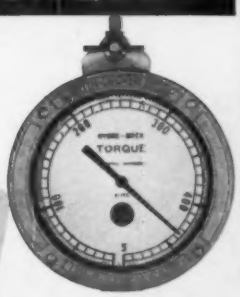
ROTARY TORQUE

for DOWN HOLE VISION



A good Weight Indicator is not enough. For complete knowledge of down hole conditions install the Martin-Decker Hydro-Mech Torque Assembly. This unit fits under the rotary or secondary chain and provides sensitive indications of:

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Fishing Operations
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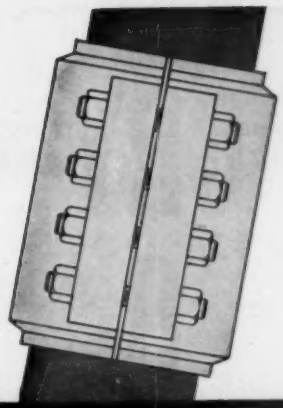
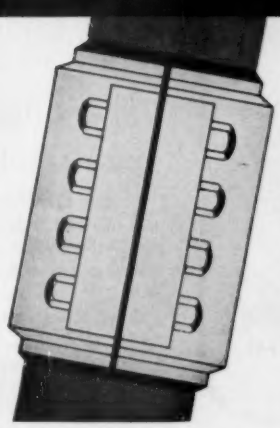


Completed Installation

FAST, SAFE PIPELINE REPAIRS WITH NEW SMITH SPLIT-COUPLING

The Smith Split-Coupling can be used as coupling, repair clamp or split sleeve.

Easy installation—Place halves around pipe. Tighten side bolts. **Permits welding while pumping.** Available in standard pipe sizes. Extra lengths and special dimensions on application.



Completed Installation (When welding is specified)

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New York 17, N.Y.

capacities from 32 to 170 g.p.m. Maximum continuous pressure rating is 300 psi. The Series 700 pump is rated at 1,000 psi. for continuous service and comes in capacities from 20 to 80 g.p.m. Source: **Brown & Sharpe Mfg. Co., 250 Promenade, Providence 1, R. I.**

•

In-line viscosity

. . . controller developed in England is designed to maintain the viscosity of various grades of fuel oil within close limits. The Smiths viscosity controller provides continuous control of the blending process to within 1%, according to the maker. Its principle of operation is such that, by use of two viscosity meters, the viscosity of a sample from a pump line is continually balanced against the viscosity of a sample prepared in the laboratory. The viscosity of each sample is measured by a rotating-cup viscosity meter, the output torque of which acts upon a balance arm. Source: **Smiths Industrial Instruments, Ltd., Chronos Works, North Circular Road, London N.W. 2, England.**

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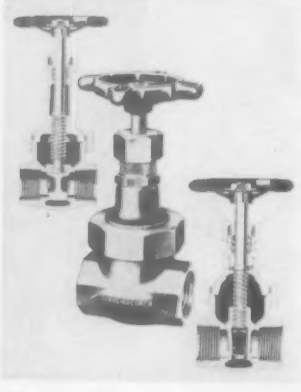

Valve offers extra safety

. . . for plant and personnel as well as a way to reduce valve maintenance costs, the maker claims. The valve is a union-bonnet bronze gate valve suitable for applications in the 125 to 150 psi. steam-pressure range. The Fig. 3125 valve has a double-wedge disk and a rising stem. Source: **Lunkenheimer Co., Beekman St. at Waverly Ave., Cincinnati 14.**

Strain gage

. . . has been developed with a sensitivity 60 to 70 times greater than metal strain gages, the maker claims. The strain-sensing element is a silicon type. Nominal resistance is 120 ohms. Resistance change is linear with strain. The Strainistor strain gage is suitable for both static and dynamic measurements. Source: **Century Electronics & Instruments, Inc., 133 N. Utica, Tulsa.**

•

Controller

. . . with slide-rule readout is an indicating type for temperature control. Its based on a null balance servo system. Temperature is maintained electronically without depending upon the meter movement for control. The Series 5000 instrument comes with either time proportioning or on-off control, with or without anticipating section. Source: **Electronic Process Corp. of California, 436 Bryant, San Francisco 7.**

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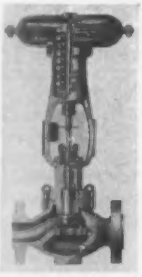
Control valve



. . . the Series 20000, is a single-seated type for process applications. According to the maker, it has the ability to handle high pressures and pressure drops and provides a wide selection of reduced-capacity trim. The control valve comes in sizes from ¾ to 10 in. with ratings in iron of Class 125 or 250 ASA, and in steel from 150 to 2,500 lb. ASA. Source: **Mason-Neilan, 63 Nahatan, Norwood, Mass.**

FOR RELIABLE, UNFAILING ELECTRIC OPERATION... It's the HYDRAMOTOR® valve, designed by General Controls for lines up to 12" diameter and offering the advantages of single-unit, sealed-in-oil hydraulic ram power that's controlled by simple 2-wire circuitry.

Electro-hydraulic power operation eliminates complicated linkages and gearing, as well as need for outside air or gas supply—and it's fail-safe because the valve returns to safe position by spring force if power is interrupted. Ideal for use in cold weather, the Hydramotor is available in a low temperature unit designed for ambient conditions to –40°F.

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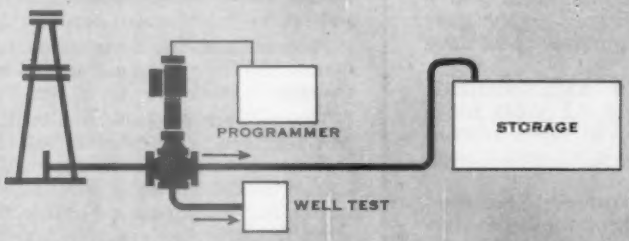
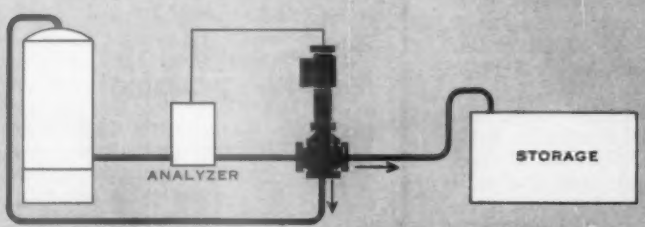
HERE'S THE VALVE THAT SOLVES YOUR OIL FIELD CONTROL PROBLEMS...

THREE BASIC TYPES of hermetically sealed Hydramotors are available in dust proof, drip proof, explosion proof and weather proof models: **Standard Hydramotors** provide open, closed, or in-between positioning. **Three-way 2-position units** provide for diverting flow from a common source to either of two outlets. **Three-way 3-position Hydramotors** carry flow from well to production, to test sampling or secondary tank, or to shut off. Hydramotor valve actuators are manufactured in a range of 180 to 6000 pounds of stem thrust and in a stroke range of ⅝" to 4½". Valve bodies of cast iron, cast bronze, cast carbon steel, stainless steel and other alloys are available in 150, 300, 600, 1500, 3000 and 6000 lb. ASA ratings.

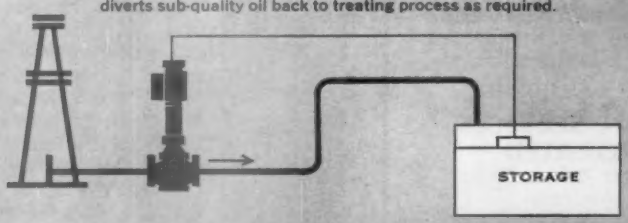
Write today for complete information. Ask for Bulletin 608.338.



WELL TESTING, 3-way 2-position Hydramotor valve samples rate and quality of flow on command or through programming equipment. The 3-way 3-position Hydramotor not only diverts flow but also provides full shut off for well shut in.



AUTOMATIC CUSTODY TRANSFER, 3-way 2-position Hydramotor diverts sub-quality oil back to treating process as required.



TANK SWITCHING, a standard Hydramotor controls level in storage tanks.

SHOWCASE . . .

New Equipment

Cold-applied emulsion coating

. . . obtainable in two types, offers high resistance to permeation by chemicals, the maker says. One coating, a polymer emulsion called Bituplastic 33, is a heavy-duty type particularly suited for intermittent splash.

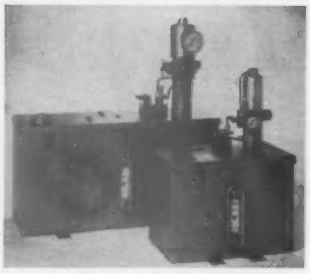
It can be applied by brush, roller, or spray to protect structural steel, deck areas, and sheet piling.

The other product, Bituplastic 44, has been successfully used to adhere cellular glass insulating blocks to storage tanks and to underground piping, according to the manufacturer, and is suited as a top coating for insulation. Source: **Koppers Co., Inc., Koppers Bldg., Pittsburgh 19.**

●

Compressor cylinders

. . . lubricated automatically with the Meter-Pak automatic lubrication system available for both compressor and



power cylinders on all types of gas and process compressors. A totally pneumatic system, it delivers lubricant in precise amounts, consistently and at prescribed intervals, to the cylinders. It comes in four models for pressure ranges up to 7,000 psi. Points of lubrication handled by one unit range up to 100. Source: **Meter-Pak, Box 1637, Houston 1.**

●

Water purity

. . . tested automatically with an automatic instrument recently developed, called an automatic tape analyzer. According to the manufacturer, the instrument can detect trace quantities of insoluble solid impurities in reflooding waters, waste waters, process liquids, and boiler feedwater and condensate.

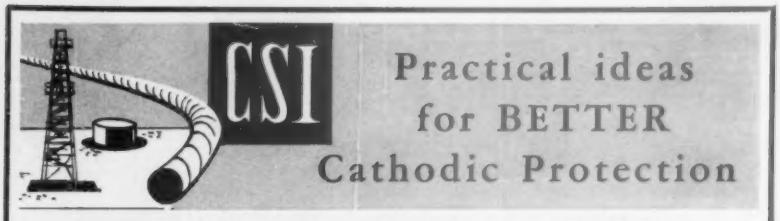
Potentially, it can be modified to sample air and gases and to detect solubles.

The analyzer automates the millipore filter test by filtering samples in sequence as often as desired through a nylon backed tape of millipore filter membrance and printing the time each sample is taken. Source: **Graver Water Conditioning Co., 216 West 14th St., New York 11.**

●

Map-filing cabinet

. . . is now on the market that permits vertical filing of up to 80 maps in less than 12 in. of cabinet depth, according to the maker. The vertical, thin line VTL 60 Series map-filing cabinet is obtainable in any finish desired to match the office for which it is intended. Source: **Port City Cabinet Works, 609 Quitman, Houston 9.**



HOW YOU SAVE MONEY BY USING "HIGH POTENTIAL" RATHER THAN "STANDARD" MAGNESIUM ANODES

Why do you use magnesium anodes to stop corrosion of pipe lines, tank bottoms, oil well casing, etc.—rather than other types of galvanic anodes that sell for less money per pound?

The answer is, of course, because magnesium gives you a lower overall cost for cathodic protection. Magnesium's higher potential (approximately 0.4 volts) makes it possible to achieve protection with fewer installations.

If the above is true, then it follows that a "high potential" magnesium anode (delivering approximately 0.3 volts more than regular magnesium) can give you an even lower overall cost. This would be especially true if there is no sacrifice in useful ampere hours of current per pound.

Galvomag, the high-potential magnesium anode developed by The Dow Chemical Company, meets both of these requirements: It delivers 20 to 35 per cent more current than standard H-1 alloy magnesium anodes; and it has a current efficiency (ampere hour rating) comparable to H-1 anodes. Other so-called "high potential" and "high current" anodes tested however, do not show current efficiencies in a comparable range.

To help you get the most for your magnesium anode dollar, we suggest that you specify Galvomag or its equivalent in solution potential and ampere hour rating.

CSI engineers—pioneers in cathodic protection—have also developed a wide variety of special sizes and shapes to make Galvomag even more efficient. For example, the use of these special sizes in "hot spot" protection of pipe lines makes it possible to lower the number of anodes required by one-third—without decreasing the amount of protection or shortening the life of the installation.

It will pay you to check with CSI—for expert engineering and installation services, plus a complete line of cathodic protection supplies for both rectifier and anode installations. Prices are competitive. Call or write today.

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Mailing Address:
Box 787, Sand Springs, Okla.
Tel. Circle 5-1351

SHOWCASE . . .

New Literature

Weldment-type dall flow tube

. . . for special metering requirements is the subject of new Bulletin 0115.20-3. The four-page 2-color literature piece contains drawings of 10 different styles together with engineering and ordering data. Source: **B-I-F Industries, Inc., P. O. Box 1342, Providence 1, R. I.**

Cementing unit

. . . for fast, efficient cementing service is described in a new four-page booklet just published. It features photos and design data on the new cement transport, the blender control panel, and the slurry weight-control record. Advantages of controlled-slurry cementing are also detailed. Source: **Dowell Division of The Dow Chemical Co., P. O. Box 536, Tulsa.**

Nitrogen-atmosphere

. . . generators bulletin gives installations, applications, features, and a comprehensive flow chart. It includes a utilities table showing the amount of gas, power, and water required to obtain maximum capacities. Source: **Gas Atmospheres, Inc., 3855 West 150th Street, Cleveland 11.**

Two-way mobile radio

. . . base station equipment is highlighted in a new booklet now available. It contains descriptions, specifications, and photographs of upright cabinets, remote control and desk-top consoles, and special a.c. utility base stations. In addition, several pages are devoted to descriptions of various base-station antennas, monitor receivers, and the new "Quik Call" selective-signalling system. Source: **Communications & Industrial Electronics Div., Motorola, Inc., 4501 West Augusta Boulevard, Chicago 51.**

New ASA price list

. . . and index lists nearly 1,900 American Standards that have been approved to date. Fields covered include chemical, construction, metallurgy, materials handling, mechanical engineering, petroleum, and safety. Source: **American Standards Association, Dept. PR 151, 10 East Fortieth Street, New York 16.**

Carbon arc-welding

. . . torch manual describes the operation and use of the process. The 16-page pocket-size handbook lists numerous industrial welding applications. Source: **Arcair Co., P. O. Box 431, Lancaster, Ohio.**

Nontechnical

. . . corporate brochure briefly describes all phases of design, manufacture, and application of Uni-Rad process heaters and furnishes background material of K. W. Anderson Co. personnel. The publication has been designed to acquaint interested people in refining, processing, and petrochemical industries with the company and its products. Source: **K. W. Anderson Co., P. O. Box 660, Tulsa.**

Teflon parts

. . . help reduce costs of maintenance, as described in an available 6-page brochure. It gives 16 illustrated case histories on how different firms arrived at these lower costs by using Teflon parts made from conventional shapes. The brochure shows uses of

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The new JENSEN COMBINATION JACK is made for rugged duty. Yet combines the best advantages of the Beam-Balanced unit and the Rotary unit. Features longer wearing Ductile iron gears—proven equal to or better than steel!

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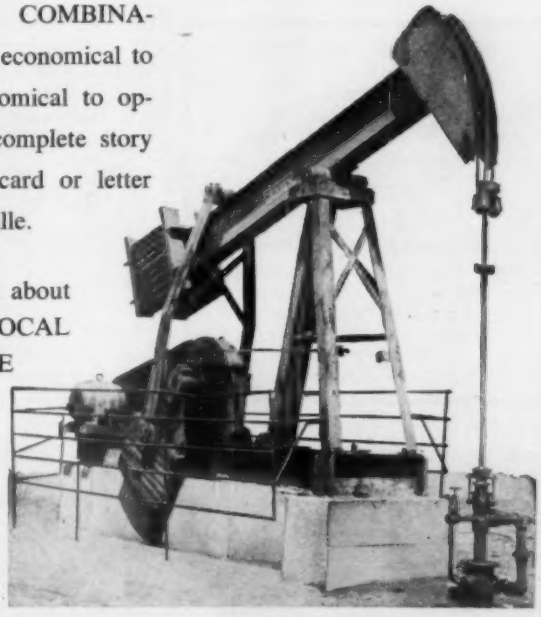

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Export Office: 250 Park Avenue, New York 17, N. Y.

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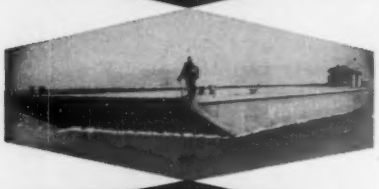
for Charter



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Teflon for gaskets, bearings, valve faces, seals, and in chemical and petrochemical systems. Other applications shown include brush-holder sleeves and bearings used in electrical work. Source: **Cadillac Plastic & Chemical Co., 15111 Second Avenue, Detroit 3.**

Eleven series of swing joints

. . . are listed in new Booklet 68-1 (12 pages) just announced. The swing joints are available in bronze, aluminum, steel, stainless steel, and ductile iron. They are listed from 1 up to 8-in. sizes for high and low pressure and up to 50,000 psi. The booklet illustrates more than 1,000 different styles, types, sizes, and alloys. Source: **Wheaton Brass Works, Springfield Road, Union, N. J.**

Welding processes

. . . for new metals are outlined in an eight-page reprint recently made obtainable. It offers a comprehensive review of problems involved in joining newer metals and alloys used in such design as precipitation hardenable stainless steels, ultrastrength steels, Rene 41, beryllium, zirconium, molybdenum, tantalum, and columbium. The reprint (Form ADB 123) also contains tabular presentation of process data on four of the metals. Source: **Air Reduction Sales Co., 150 East Forty-second Street, New York 17.**

Velocity perforating

. . . charge with an acid projectile, known as the Stinger perforator, is detailed in a four-page booklet recently published. It presents a cutaway of the charge showing the design principle, advantages, and uses. Source: **Western Co., P. O. Box 186, Fort Worth.**

Countercurrent extractors

. . . designed for complex solvent extractions are discussed in new Bulletin 2567. Applications include extracting aromatics for hydrocarbons and washing many types of hydrocarbons. Containing numerous cross-sectional diagrams, performance curves, and tabular data on yields, the eight-page publication gives complete descriptions of both two and three-stage extractor models. Source: **Centrico, Inc., 75 West Forest Avenue, Englewood, N. J.**

Telemetering bulletin

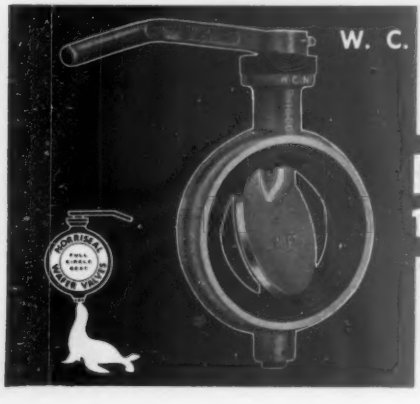
. . . describes Bristol Metameter telemeters. Contents of Bulletin M1715 include: principles of operation; types of telemeters; application to various measurements, including pressure, water level, temperature, flow, motion, and position; and electrical quantities. Source: **Bristol Co., Waterbury 20, Conn.**

Corrosion inhibitors

. . . for petroleum producers are highlighted in an eight-page brochure now available. It explains application methods of Kontol corrosion inhibitors to oil and gas-well systems. Schematic drawings, graphs, and photos are used to describe the product and its applications. Source: **Tretolite Co., Div. of Petrolite Corp., 369 Marshall Avenue, St. Louis 19.**

Gas-lift equipment

. . . Bulletin 859 (8 pages) discusses gas-lift valves, surface controllers, orifice gas-well testers, and plunger equipment. Operating ranges, specifications, and pictures are included. Source: **Merla Tool Corp., P. O. Box 2576, Dallas.**



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THE OIL OF TOMORROW may come from deep beneath the icy wastes of the Arctic. If it is there, our petroleum industry will find it, produce it and thus add to precious petroleum reserves . . . and O-C-T will be there with the best possible equipment and service.

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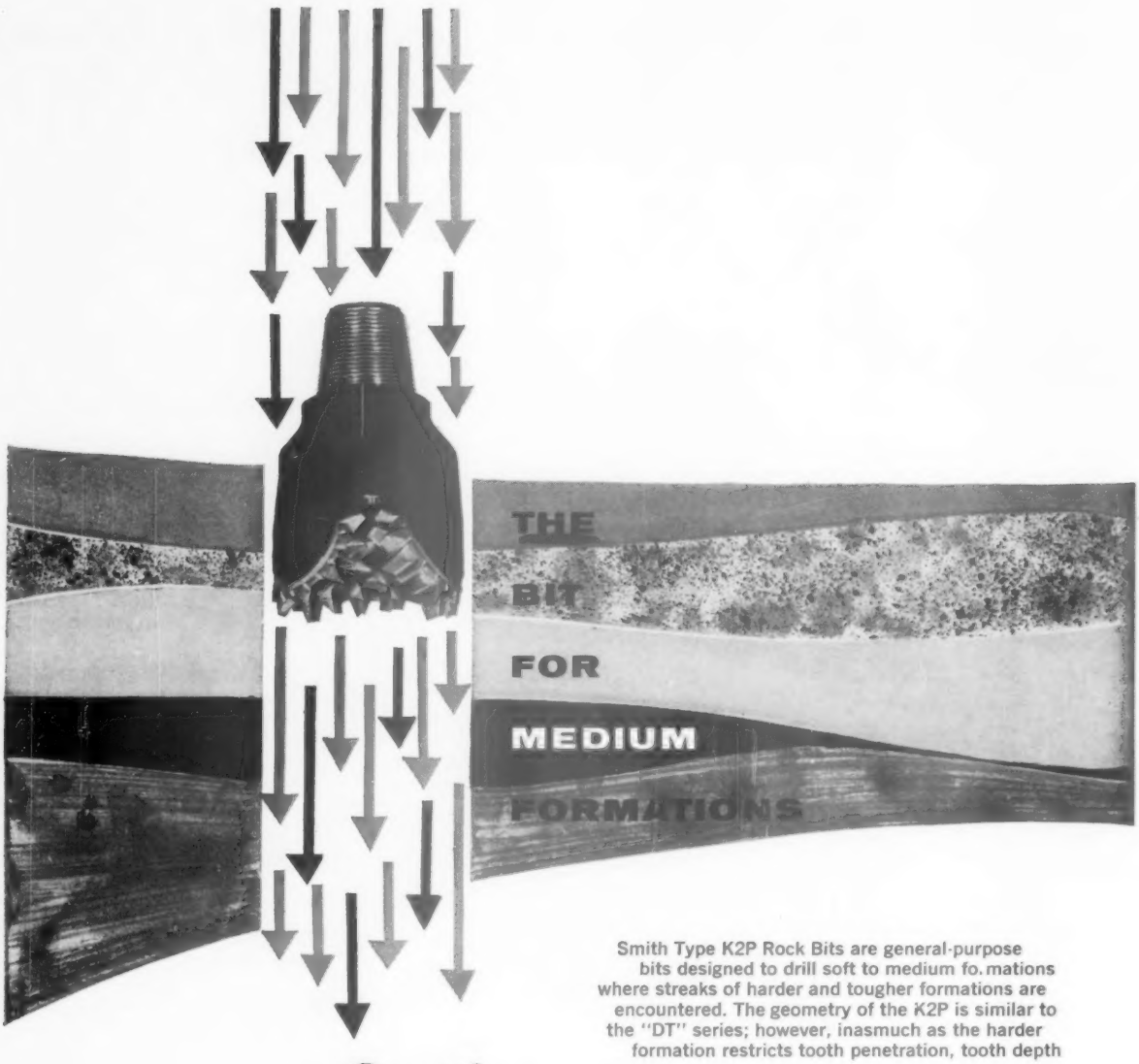

Smith Type K2P Rock Bits are general-purpose bits designed to drill soft to medium fo. mations where streaks of harder and tougher formations are encountered. The geometry of the K2P is similar to the "DT" series; however, inasmuch as the harder formation restricts tooth penetration, tooth depth

Smith type K2P 3-cutter rock bits

has been decreased to provide for an increase in bearing capacity. The rows of teeth are more closely spaced in order to efficiently penetrate the harder formations, whereas gage-tooth deletions are maintained to prevent packing in the softer formations that may be encountered. The design provides a balanced bit having a relatively long cutting life and a favorable rate of penetration.

Smith TOOL CO.

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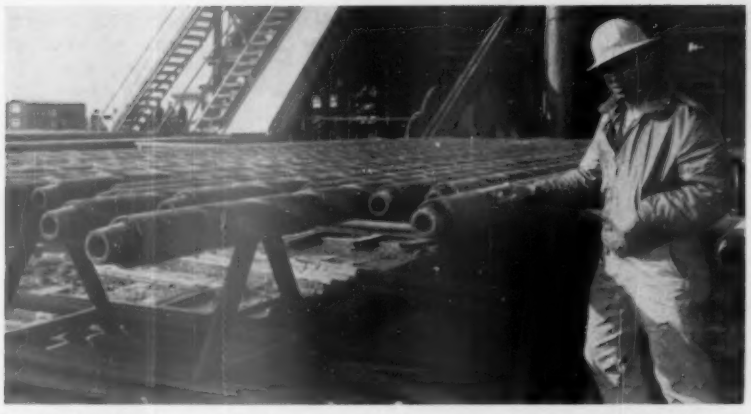


SPIRAL GROOVES on drill collars may be the answer to wall sticking of collars. According to a study group of the API (see OGJ, March 21, 1960, p. 84) it has been estimated that from 40 to 90% of all fishing jobs that occur while drilling are caused by differential pressure sticking against porous formations. This is claimed to be due to the fact that the pressure in the hole is higher than it is in the pores of the formation. The pipe shown on the rack is grooved and this allows the pressure to equalize on all sides of the collars in the hole even when laying tight against a porous bed. Doug Donaldson of Engineering Enterprises, Houston, points out the depth of the grooves.

Other approaches to overcome wall sticking include: reducing pressure in the hole; adding water, oil, or chemicals. Decrease of water loss of muds and improvement of mud cake are other methods that may solve this sticky problem.

Los Angeles drilling moves in closer

TOWN-LOT DRILLING is old hat in California and especially Los Angeles. A more pertinent question now is, how far downtown will it go?

By the looks of things it could go as close as physically possible. Parts of the city are known to lie over old shallow oil fields that became virtually stripper production years ago. Is there possibility for deeper pays below these depleted zones? Apparently so, because here's what is happening:

A wildcat well is being drilled one mile south of the center of the downtown area on Alameda Street, south of Seventh. Standard Oil Co. of California, Western Operations, Inc., is drilling in a heavy industrial zone on the property of Southern Pacific Co.

Over 16,000 property owners have been signed up by Standard Oil and these oil and gas leases cover 3,500 acres. This is probably the largest community lease block in the city.

Surrounding the well, the block reaches out about a mile from the drilling location. The operator has not revealed the exact limits on the leases involved and it is yet undetermined how much of the downtown area is affected.

Spudded on June 15, the well is working below a depth of 2,500 ft. No district drilling permit was required from the city council because the area is zoned for heavy manufacturing and is classified as M-3. In this case drilling for oil and gas is considered a "right."

The zone rating exempts the operator from some of the rigid restrictions of other town-lot sites where zoning approaches the strictly residential neighborhoods. All fire precautions are required of the operator and the fire department issued a permit after approval was given by other city departments.

The company will apply for an urbanized oil drilling district if the venture is successfully completed. This governs all drilling in business and residental zones.

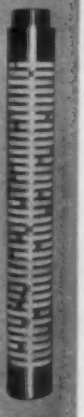
Texas company takes over Canadian firm

ALL ASSETS of Double A Drilling Co., Ltd., of Calgary, Alta., have been acquired by Llano Drilling Co., Midland, Tex., from F. J. Johnson of Calgary and Alvin Johnson of Oil City, La.

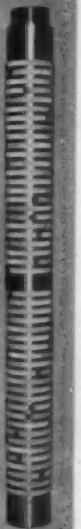
The assets include three rotary rigs rated at between 2,500 and 8,000 ft. Llano plans initially, at least, to continue operating in Canada under the Double A name. Other than the former officers, all personnel will be retained. For the next 6 months, Jack D. Riggs, president, and Paul H. Meyer,

Let R-u-b-b-e-r Take The Wear
in your sucker rod pumps

IT COSTS YOU LESS THAT WAY

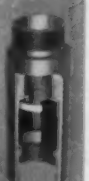


● MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.



● MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

● The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)



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Knockout punch! In seconds, fire can have your business on the ropes. Keep your guard up by protecting storage rooms for volatile solvents, gases, flammable liquids with a *fully-automatic* Kidde carbon dioxide extinguishing system. U.L. and F.M.-approved Kidde systems actuate at the first flash of fire, smother it in seconds, leave no mess, turn off power and sound an alarm. Kidde's 35 years' experience can help you protect *any* hazard. Write today and find out how.

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Walter Kidde & Company of Canada Ltd.
Montreal — Toronto — Vancouver

vice president, of Llano in Midland will alternate in supervising the Canadian work.

Llano now operates four rotaries in the Permian basin—all rated at 10,000 ft. and deeper—and a fifth in Colombia working for Forest Oil Corp.

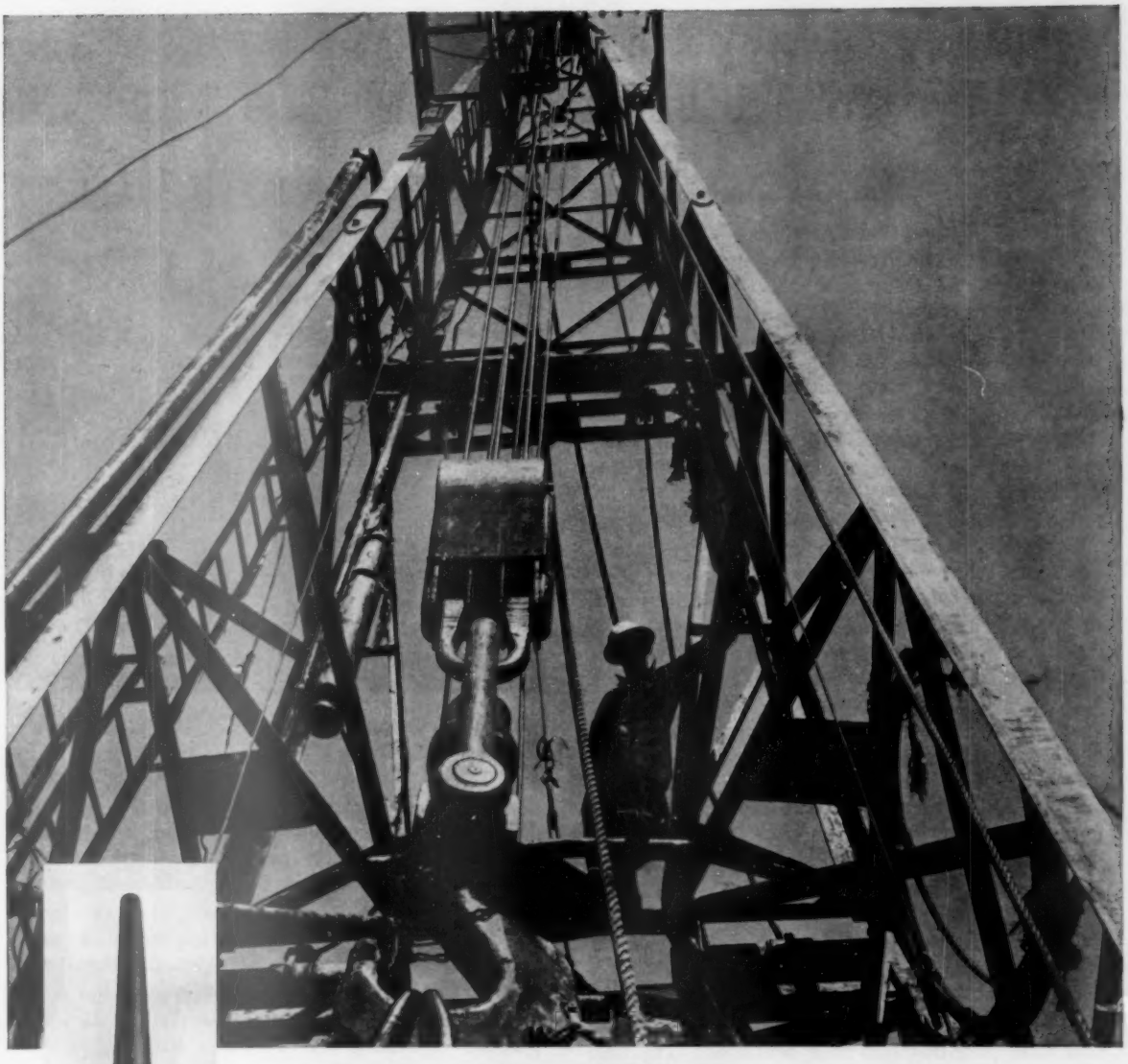
A new feature

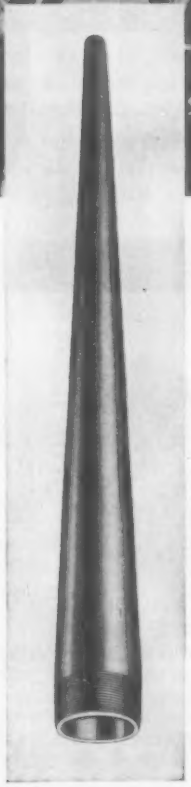
Starting this week the Journal will carry in this section an active-rigs report which tallies the rotary and cable-tool units which are active. This includes all units from rigging-up to tearing-down stage and those tools that are drilling, logging, testing, cementing, completing, fishing, or temporarily shutdown. Cable tools do not include rigs completing rotary-drilled holes.

Active Rigs*

	Rotary	Cable	Total†
Alabama	3	0	3
Alaska	1	0	1
Arizona	1	0	1
Arkansas, South	32	0	32
California, Offshore	6	0	6
Inland	121	2	123
Colo., excl. Four Corners	24	9	33
Four Corners	6	0	6
Florida	2	0	2
Georgia	3	0	3
Idaho	0	0	0
Illinois	49	29	78
Indiana	19	26	45
Iowa	1	0	1
Kansas	90	19	109
Kentucky	15	52	67
Louisiana, North	97	0	97
South Inland	229	0	229
Offshore	55	0	55
Total	318	0	381
Michigan	49	31	80
Mississippi	59	0	59
Missouri	1	1	2
Montana	24	2	26
Nebraska, East	1	0	1
West	23	0	23
Nevada	1	1	2
New Mexico, East	99	24	123
West	38	7	45
North Dakota	18	0	18
Okla., excl. Panhandle	243	75	318
Panhandle	27	9	36
Oregon	0	0	0
South Dakota	1	2	3
Texas, Offshore	1	0	1
East	77	0	77
Upper Gulf Coast	113	0	113
North	116	2	118
Panhandle	60	14	74
S.W., Corpus Christi	127	0	127
S.W., San Antonio	37	6	43
West	203	16	219
West Central	70	18	88
Total	804	56	860
Utah, North	9	0	9
South	17	0	17
Washington	0	0	0
Wyoming	58	8	66
U. S. total	**2,243**	**353**	**2,596**

*Report to AAODC by the International Oil Scouts Association.
†As of June 17, 1960.





DEEPER AND DEEPER

with CF&I Seamless Casing and Tubing

The deeper wells and advanced equipment required for today's oil recovery demand the finest in casing and tubing — CF&I Seamless Casing and Tubing. The CF&I mill at Pueblo uses equipment rated among the most up-to-date in the industry. Production techniques feature unusually exact quality controls.

From its central location, CF&I Seamless Casing and Tubing can be distributed rapidly to the major oil fields. All CF&I Seamless Casing and Tubing is made to API specifications, in sizes 2⅜" to 9⅝" O.D. For full details, contact your local CF&I Sales Office or our General Sales Office, Denver, Colorado.

7760

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THE COLORADO FUEL AND IRON CORPORATION

DENVER, COLORADO

A TALE OF TWO FLOODS

HOW TWO WATERFLOOD OPERATORS INCREASED

CASE NUMBER ONE

This major oil company, operating a shallow waterflood unit, was experiencing severe declines in some producing wells.

In 1956, five wells were fractured. Production increases were so encouraging that the fracturing program was continued. Results have been analyzed only through 1958, but recent experiences have been at least as good or better than earlier results.

During the three years under study, 52 producing wells were fractured by Dowell and 6-month tests were obtained.

Production before fracturing averaged 2.1 bopd for all 52 wells. Six months after fracturing, production averaged 19.5 bopd—an average increase of 17.4 bopd or a percentage increase of about 930 per cent.

In addition to the producing wells, many injection wells were also fractured so that increasing volumes of water could be handled with a minimum addition of wells and pumping equipment.

Three-month reports are available on 20 such injection wells. Before fracturing, the wells would take an average of 44 bwpd at line pressure. Three months after fracturing, they would take an average of 202 bwpd—a 4.6-fold increase.

No exact monetary value can be placed on this increase, but it is obvious that the system could handle more water without increases in equipment and power requirements.

CASE NUMBER TWO

This independent operator started flooding a Bartlesville sand pool that had been abandoned. The field was originally opened up in 1917 and had been depleted by primary methods.

Early in the flood, the operator found that conventional five-spot flooding of the central part of the pool did not yield economical production. A general policy was developed to inject water in the central part and drill producing wells around the periphery.

Apparently there was still considerable oil in place along the edges, but the relatively tight formation prevented profitable producing rates without fracturing.

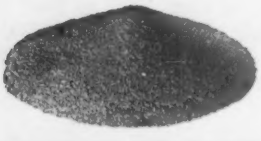
In 1952, the first two fracturing treatments were performed. Results were so encouraging that a systematic program of drilling and fracturing was started. By

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **a major oil company**
- Number of fracture treatments — **52**
- Average production per well before fracturing — **2.1 bopd**
- Average production per well **six months** after fracturing — **19.5 bopd**
- Average per cent increase in production — **930 per cent**
- Approximate cost of all treatments — **$27,000**

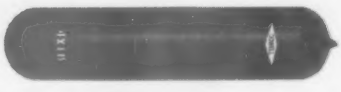
MORE IDEAS FROM DOWELL

TO HELP INCREASE PROFITS FROM SECONDARY RECOVERY



MAGNESIUM PELLETS

are often pumped into the formation before acidizing to heat the acid and melt away heavy hydrocarbons that might be blocking either injection or production. These treatments have proved remarkably successful.



ROCKSHOCK*

(Implosive formation treating service) is proving valuable both for formation cleaning and fracture initiation. It often makes possible the fracturing of formations that could not otherwise be fractured.

EZEFLO*

is a new Dowell surfactant. Available in bulk, it is especially useful for lowering water injection pressure. It is suitable for any use where an efficient, concentrated nonionic surfactant is indicated.

PROFITS WITH DOWELL STIMULATION SERVICES

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **an independent producer**
- Field had been abandoned before waterflood started
- Number of fracture treatments — **34**
- Cumulative production from fractured wells* — **866,512 barrels**
- Cost of fracturing* — **$25,828**
- Fracturing cost per barrel of oil — **3 cents**
- Fracturing cost as a percentage of total production cost — **less than two per cent**

*to December 31, 1959.

the end of 1959, 34 frac jobs had been performed at a total cost of approximately $25,828. All but a few of the earlier jobs were performed by Dowell.

Fracturing fluids, sizes of jobs and techniques were modernized and improved, as the program continued, to assure the operator of the greatest possible return on his investment.

Cumulative production from these wells totaled 866,512 barrels by the end of 1959. The net sales price of the oil was in excess of two million dollars. Cost of the fracturing treatments amounted to 3 cents per barrel of oil produced or less than two per cent of the total cost of producing the oil.

For this two per cent, the operator changed a flood that was headed for economic failure into an excellent financial success.

These field studies are just two more examples of how Dowell services can help operators improve production, keep down costs, improve profits and speed payout on investment.

You may run into a wide variety of problems in addition to oil production when you operate water disposal, gas injection or waterflood facilities. Your Dowell representative has a wide variety of services and products—both new and old—to help you solve your problems. A few examples are noted in the box below.

In addition to those services mentioned here, Dowell offers the Frac Guide*, the Acid Guide*, Cealment*, Corban* and Freflo* to help solve problems of secondary recovery. For more information on how Dowell can help you increase profits from your secondary recovery, pressure maintenance, water disposal or gas injection projects, **dial Dowell.** Dowell services and products are available from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina and Germany. Dowell, Tulsa 1, Oklahoma. *Dowell Trademark

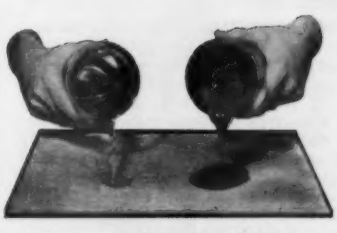
Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

ABRASIJET*

(Dowell-developed abrasive jetting service) can be used to initiate fractures, perforate or clean the formation face. On injection or disposal wells the result is often a good increase in receptibility and/or a lower injection pressure. On producing wells, the results have been higher production, better gas/oil or oil/water ratios or improved results from fracturing or acidizing.



STABILIZED ACID

is regular acid with a special addition agent to prevent the deposition of gummy iron or aluminum hydroxides which might otherwise plug formation pores.

GYPBAN*

is a Dowell agent that is used to prevent formation plugging by water-formed gyp deposits. It is oil-insoluble and dissolves only gradually in water, thus providing months-long protection.

▶▶▶ Equipment Men Notes

Mac W. Miller to represent

... McEvoy Co. in the Dallas-Fort Worth and North Texas area, following his appointment by J. H. Foster, McEvoy's western regional manager. Operating from the company's Dallas sales office, Miller's primary responsibility will be to provide engineering assistance to help customers solve problems in specifying wellhead equipment and other products.

Ray E. Gorman takes over

R. E. Gorman

... as regional sales manager of the Mid-Continent and Permian Basin areas and the Dallas-Fort Worth district for Baash-Ross Division of Joy Mfg. Co. The announcement comes from R. A. Forsman, director of sales and service at the Baash-Ross Houston office. Gorman formerly was Mid-Continent sales manager and division sales manager for Web Wilson Oil Tool Co. before its purchase by Baash-Ross.

The new regional sales manager has worked in the oil-field-supply business since 1935. He will maintain offices in Dallas.

W-K-M Division names two

... sales executives, along with three district managers and four product managers, reports B. J. Gross, marketing vice president of W-K-M Division of ACF Industries, Inc., Missouri City, Tex. Glen Tableman was named sales manager and Paul J. Natho became manager of the newly created market-development department.

Reporting to Tableman will be three district managers—Ross Spencer, southwest; Gaston T. White, southeast; and William Giffhorn, Mid-Continent. Working with Natho will be four product managers—M. J. Conley, oil field; Paul Nerren, pipeline; Bart Braznell, refinery; and Bob Butler, industrial.

Fisher Governor Co. conducts

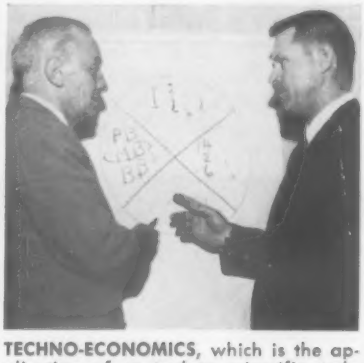
... a 3-day (80th anniversary) sales meeting in Marshalltown, Iowa, for 150 sales representatives from offices throughout the United States, Canada, Mexico, and England. Fisher executives presented a picture of the company's progress, after which personnel of technicial departments introduced the representatives to coming developments in products, materials, and trends. Also shown were new products soon to appear on the market. The meeting was also devoted to equipment and plans for the gas industry.

NEW QUARTERS have been completed for Continental-Emsco Co.'s Lake Charles, La., supply store. The occupancy of this building enables C-E to have all new stores in its South Louisiana division. Nealy Nevils, Jr., is manager of the store, which is under the supervision of Division Manager E. A. Dunn, who maintains an office in New Orleans.

Varel Mfg. Co. announces

... the letting of a contract for a $100,000 plant in Rouiba, Algeria for the manufacture of rock bits to be known as Varel Afrique. Arrangements were concluded by D. W. Varel, president, after 2 years of negotiation with the Algerian government.

Varel is the first American manufacturer to be granted a permit to operate in the area. Varel Afrique will operate on the same basis as in the home plant in Dallas. It will include a modern heat-treat plant as well as complete machining facilities for the manufacture of the bits.



TECHNO-ECONOMICS, which is the application of up-to-date scientific techniques in both management and technology, is a term often used by Dr. Richard Woodbury, left, of the Southwest Research Institute in San Antonio. A 3-day seminar, conducted recently by Woodbury for Weatherford Oil Tool Co., Inc., was attended by Weatherford personnel from all over the world. Pictured with Woodbury is Jess E. Hall, Jr., president of Weatherford. The seminar sessions, alternating between San Antonio at Institute headquarters, and the Weatherford offices in Houston, were concerned with long-range planning for the company's corporate development and with assessing Weatherford's present position in the industry.

Axelson Division appoints two

... to district-manager slots in the firm's hydraulic department, according to L. G. Evans, vice president in charge of sales, Axelson Division of U. S. Industries, Inc.

J. L. Thompson

C. C. Call

Newly named are Jack L. Thompson, transferred from Casper, Wyo., to Denver, and C. C. Call, who will locate at the company office and warehouse at Odessa, Tex. Call was promoted from the post of sales engineer serving in Odessa.

J. J. Sieber elected to board

... of directors of Broderick & Bascom Rope Co., of St. Louis. He is the company vice president in charge of sales.

Sieber went to work in the firm's engineering department, St. Louis plant, in 1929. From there he became field salesman, Chicago branch manager, western product engineer at the Seattle factory, chief engineer at St. Louis, sales manager, and vice president in charge of sales.

William Siegel goes to Tulsa

... as district sales manager of Heat & Power Co., Inc., according to Aaron Siegel, president. The new sales manager was formerly assistant manager in the company's New York office.

Clayton A. Smith is appointed

. . . sales representative of Southwestern Pipe, Inc., Houston, announces Charles A. Rawson, executive vice president. Smith will locate in Dallas and will service the area of Dallas, Fort Worth, Wichita Falls, Shreveport, and El Dorado.

For several years Smith was with an oil-field-supply firm in Borger and Pampa. More recently he served in the purchasing department of Seaboard Oil Co. In 1958 he became purchasing agent of Stekoll Petroleum Co. in Dallas.

Tuboscope names Ben L. Berry

B. L. Berry

. . . to the newly created post of domestic sales manager, according to Bill E. Thomas, marketing manager of the Houston concern. Berry previously was Tuboscope's southeast zone manager. Now he will have charge of sales within the continental limits of the United States, and will work as an assistant to the marketing manager.

Berry formerly served 7 years for Tuboscope in Corpus Christi, 2½ years in Houston, and 3 years in Louisiana. He recently moved to Houston from New Iberia, La.

Joseph A. Heineman, Jr. named

J. A. Heineman

. . . resident manager of sales for the Tulsa sales office of Jones & Laughlin Steel Corp., announces John E. Timberlake, vice president of sales. Heineman had been a salesman in the Tulsa office since 1951. He joined J&L in 1948 as a sales correspondent at the Cleveland sales office. Formerly he was with Armco Steel Co. and Steel Strip Sales Co.

Clark Bros. Co. makes

. . . the following sales appointments for the Houston-Corpus Christi area: Stewart L. Babbitt, service manager at Houston, named sales engineer for the same office; G. M. Woodman, small-engine salesman, Corpus Christi, assigned to the Houston district in the same capacity; C. R. Apitz, special representative for gas turbines in Dallas, assigned to the Houston office as senior sales engineer; and F. J. Shaw, application engineer in Houston, named sales engineer for the Corpus Christi area.

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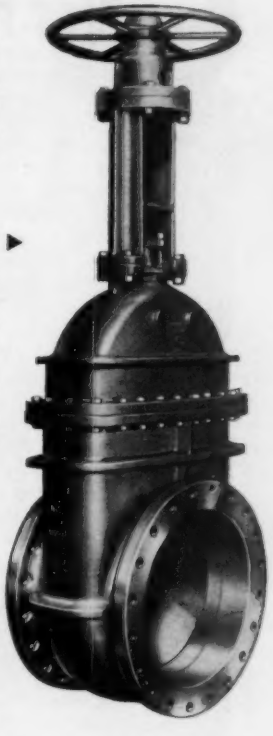
—famous for *consistently* trouble-free operation in all kinds of service. Revolving disc principle assures easy operation, surer closure, minimum friction, automatic seating compensation, extreme life with minimum maintenance. Ask for Catalog 57.



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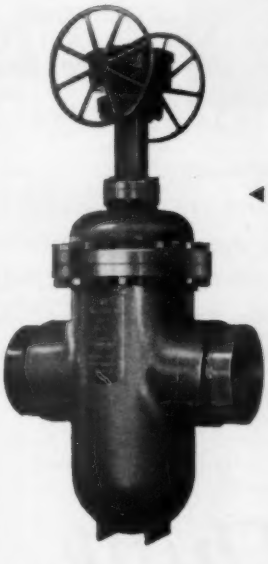

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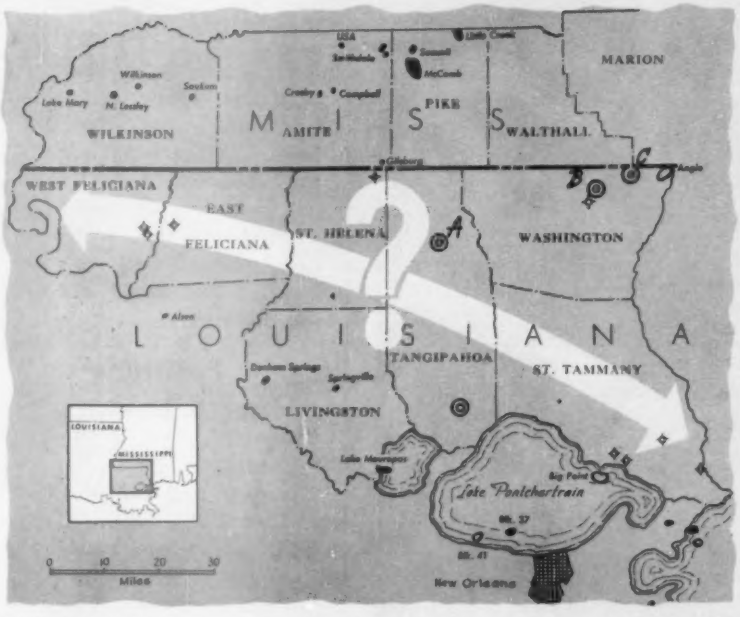


DRILLS ARE BUSY in southwestern Mississippi and in the Florida parishes of southeastern Louisiana. A hit at the Tangipahoa wildcat (A) could launch a two-state search and open an entirely new Tuscaloosa-Cretaceous province in this barren country. The well in southern Tangipahoa Parish was abandoned at 9,250 ft.

South Louisiana aims at new target—Cretaceous

BY FRANK J. GARDNER

AFTER YEARS of exploratory neglect based on prejudice, the so-called "Florida parishes" of southeastern Louisiana may soon emerge as a promised land instead of a no man's land for the oil hunter.

This row of barren parishes, striking west-northwest by east-southeast across Louisiana's lap lies between the Mississippi salt basin on the north and the Gulf Coast salt basin on the south. They've been neglected by explorers and students alike, for there's little mention of them in geologic literature.

Rewards across the line . . . Now, however, events are shaping up that may change all this. The booming counties of southwestern Mississippi (Amite, Pike, and Lincoln) may spill their Tuscaloosa-Upper Cretaceous success over the state line into West Feliciana, East Feliciana, St. Helena, Tangipahoa, Washington, and St. Tammany parishes before the year is out.

Here's the wildcat tally in these six parishes for the past 10 years:

1950	5	1955	2
1951	2	1956	3
1952	6	1957	2
1953	4	1958	0
1954	2	1959	5

That's not a very bright record for explorationists to look back on . . . about 1 wildcat per 120 sq. miles.

May spill over . . . So far this year, four wildcats have failed in the area under study, while three more are making hole (see map).

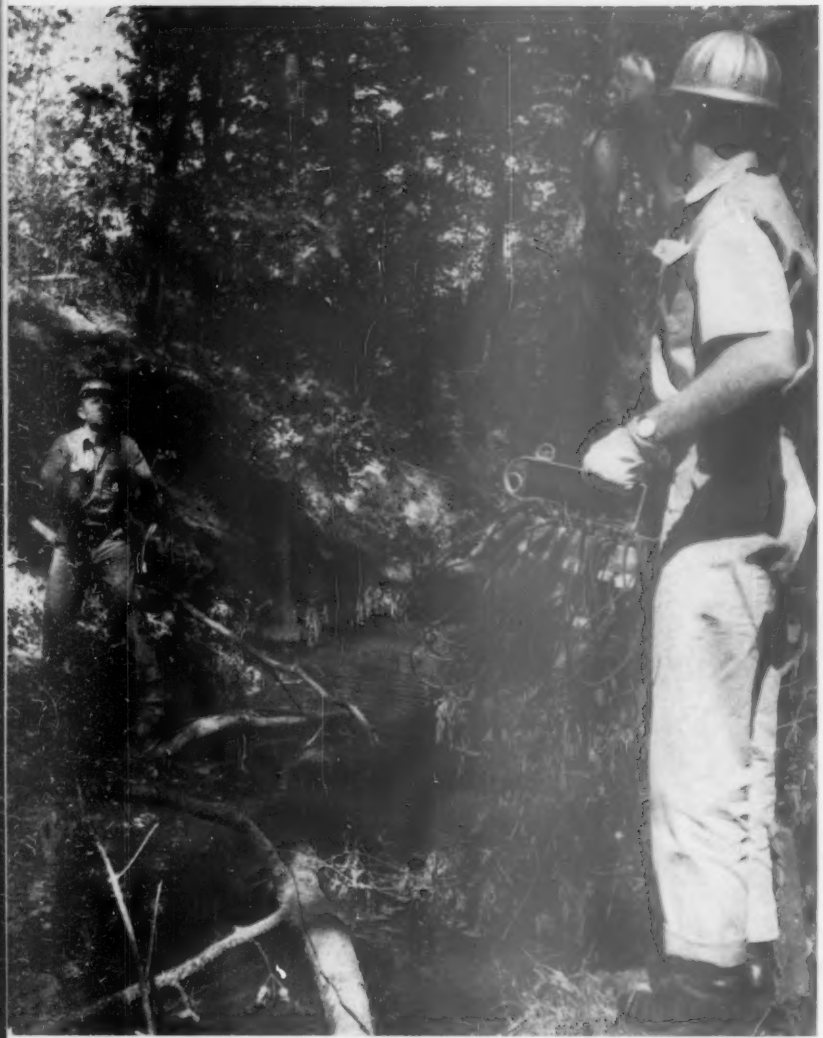
At one of these, in Tangipahoa Parish, Floyd Williams et al. have set 5½-in. pipe at about 12,260 ft. for a test of lower Tuscaloosa sand through perforations at 12,174-91 ft. This wildcat, the 1 Lake Superior Piling Co. (A on map), was drilled to 12,406 ft. No drill-stem tests were run in the hole, but pipe was run and perforations made on the basis of sidewall core evaluations. Located in Section 5-3s-8e, it will be a closely watched operation, for success at this well could launch a drilling play all up and down the Mississippi-Louisiana line.

The two other active wildcats along the trend are both in Washington Parish, west of Angie gas-condensate field, a two-state reservoir discovered in 1951. These are Nelson Gibson et al. 1 Crown-Zellerbach (Section 2-1s-13e) at C on map, and Ginther, Warren & Co. 1 Gaylord Container Corp. (Section 22-1s-13e) at B on map.

And launch a play . . . This year, for the first time, the AAPG June Bulletin, annual resume of exploration stateside, took note of activity in the Florida parishes. These parishes, according to Authors D. W. Love and D. R. Duncan, " . . . had an unusually high rate of leasing and geophysical activity during 1959 . . . and it is expected that 1960 will show a considerable increase in exploratory drilling . . . The primary objective . . . is the lower Tuscaloosa sand (Upper Cretaceous) . . . During the latter part of 1959, several major companies assembled sizable lease blocks or checkerboard spreads . . . Of the 804 reflection seismograph crew-months spent in South Louisiana during 1959, 25.2 crew-months were registered in the 'Florida parishes.' "

Meanwhile, across the fence in Mississippi, lower Tuscaloosa strikes are popping up all across eastern Amite County. These are outgrowths of the tremendous successes in Lincoln and Pike counties to the east and northeast, where explorers have been rewarded with the 100-well McComb field and 150-well Little Creek field. These are Tuscaloosa producers at the 10,800-11,000-ft. level. The past few weeks have seen new strikes at Smithdale, and Southeast Smithdale, plus three indicators still on the active list (see map). These three are Larco Drilling Co. 1 USA (Section 15-4n-3e), Justiss-Mears & D. C. Latimer 1 Campbell, (Section 27-3n-5e), and C. F. & H. Oil Co. 1 Crosby (Section 29-3n-5e). The Larco well, incidentally, promises to open the first upper Tuscaloosa reservoir in this part of Mississippi; operator is now testing the section at 10,458-74 ft.

At half-time, 1960, then, the Florida parishes have already set a record for wildcat drilling. What the second half will bring may well be determined by results of testing at the Tangipahoa wildcat at A on the map.



WORKING in this rugged East Texas terrain, this seismic party with a minimum complement shows . . .

What's a "stub" crew?

A stub crew is an abbreviated seismic field party with a minimum of personnel. Sometimes called a "bobtail" crew, it is usually used for experimental work or short special jobs. A standard crew will vary upward from 10 field men. This crew has six men.

• Positions

Surveyor and permit man
Driller
Assistant driller
Observer and party manager
Recorder-helper—assists surveyor
Party chief—assists in field

• Equipment

Tractor-mounted drill
Tractor-mounted water and shooting truck
Conventional recording truck
Personnel station wagon
Surveyor's pickup

Adapted from an article which appeared in "Cities Service Empire," March 1960. Photos courtesy of Cities Service Oil Co.

How a "stub" seismic crew operates

HERE IS THE STORY of how one oil firm uses "stub" crews to do its exploration work.

Using seasoned veterans, the work is done with a minimum of men and vehicles. A normal seismic field party has at least 10 men in the field along with 3 or more people in the office to compute the records and make maps.

Why did Cities Service Oil Co. choose to send a small crew into the field and what is the purpose? In the first place a stub crew with only the basic number of vehicles is flexible, efficient, and economical. The specific purpose is to determine what techniques are most applicable to a specific area and how to obtain the best records. Normally this abbreviated party is not used for extensive long-term projects—those jobs are done by conventional crews.

Objectives of the undersized party are to shoot additional short-line control in areas already worked, evaluate small-acreage blocks, rework lines previously shot using a new approach, and conduct basic research in seismic techniques.

This field party differs from the orthodox crew in that it has only five permanent field men and five vehicles. The party chief is the sixth man who doubles in brass by working mostly in the office, but assisting in the field when warranted.

The field boss is the observer, who is also the party manager. The surveyor does the permitting of the assigned lines and the surveying. If he gets in a bind and permits become difficult, the party chief lends a hand. Most of the surveying is done by one man. Portable self-standing rods on a tripod base

SIX MEN who make up this field party include (from left) C. J. Morvant, surveyor; C. M. Kent, driller; Sheldon Chiasson, assistant driller; C. A. Morvant, recorder-helper; Melvin Pollock, observer-party manager; and George T. Hynes, party chief.

GETTING LANDOWNER'S PERMISSION is part of the surveyor's job. Surface owners are usually more cooperative when they are shown the tractor-mounted equipment.

SURVEYING is practically one-man job by the use of stadia-rod tripod. Two are used. Only in chaining does the surveyor need assistance. Ultimately even this will be abolished.

A NEW TOOL which will make chaining a one-man operation while measuring geophone spacings is the chaining wheel shown here.

eliminate the necessity of a rodman. At present two men are used in chaining the phone spacings. The recorder-helper assists the surveyor. Ultimately, a chaining wheel will make the surveyor completely independent by eliminating one of the two-man chaining team.

The driller and assistant driller do the work of four or more men on the standard crew. They drill and load the shot holes and then shoot them. They assist the observer and his helper in laying out cables and connecting the geophones.

BRUSH CUTTING is a joint project which can be done by any or all of the field crew along the cable spreads.

AN EXAMPLE of personnel versatility—keynote of stub crews. Drilling crew loads and shoots hole after drilling it.

RECORDER-HELPER is securing cap wire of charge until hole is shot.

THE DRILLER and his assistant use portable mud tanks for setups to save water. The tractor-mounted drill is extremely mobile.

The observer and his assistant are the focal point of the crew. They record, lay cables, set phones, and assist wherever needed. On difficult lines through brushy country, any or all members of the party pitch in to cut brush. When driveouts are impossible, chest reels are used to lay the cables.

The crew shown in the pictures is one of four stub crews that Cities Service has in the field. Average experience of these men is 10 years.

Cities Service has had years of experience with stub srews. No longer an experiment, it is quite likely that the four parties of this type will be working for years to come. The effort appears worth while. Each man on the party can work in any of the other positions. Each of the five men drives a vehicle and there is no lost motion usually associated with a caravan of lumbering equipment.

One crew has worked 14 different locations in 10 counties of 3 states in a year. As long as supplemental control work is done by seismic parties, it is likely that stub crews will be around a long, long time.

CABLE IS LAID along fence, and surveyor helps recorder-helper place geophones. Experience and versatility of all crew members pay off when cable is hand-laid.

CHECKING THIS RECORD are observer-party manager and the party chief. Technical evaluation of every record maintains high record quality stub crew strives for.

PARTY CHIEF computes and maps crew's records when not working in the field. In this case crew offices were in Tyler where record interpretations were done.

FIRING THE SHOT is the climax of any seismic crew's effort. Men pause momentarily to watch hole blow before resuming chore of picking up phones and cable, and moving on to next point.

Summer drilling program set for Washington

THIS SUMMER, Sunshine Mining Co. and Cascade Natural Gas Co. will jointly drill two 6,500-ft. wells in western Grays Harbor County, Washington. Their 1 Rayonier falls approximately 12 miles north of the Sunshine 1 Medina, Washington's lone producing oil well (currently flowing 3 bbl. per day), and approximately 2,600 ft. southeast of the Tideland Oil & Gas Co.'s 1 Carlisle-Estate, which recovered 20 ft. of clean oil on a drill-stem test of the interval 3,392-3,541 ft. last fall. The 1 Carlisle-Estate is currently suspended, waiting pump installation.

The second Sunshine-Cascade test will be a southeast offset to Sunshine's 1 Sampson-John (Old City field) which recently indicated commercial potential of 1.6 M.M.c.f.d. of gas plus distillate on a 30-day production test, according to reports of Sunshine. The well, 1 Oscar, is scheduled to spud 30 days after the abandonment of 1 Rayonier.

Sunshine and Cascade plan air drilling rather than conventional fluids in an attempt to overcome heaving shale difficulties which have plagued drilling operations in the past. Certainly some new approach is needed to successfully complete wells that have indicated initial high potential on drill-stem tests but decline to a mere dribble after the well is completed. Part of the problem may well be that initial permeabilities are destroyed by contact of water in drilling fluids with potential sand zones containing minerals which expanded on contact with water.

Probably the real hope in the Sunshine-Cascade two-well program is that new zones with better porosity and permeability than encountered in previous wells will be found. Some 10 wells drilled in the field area near Ocean City and several additional wells located to the north and northeast have demonstrated high-gravity oil and gas saturation where the tiniest bit of porosity and permeability is developed. A good permeability sand would undoubtedly put western Grays Harbor County, Washington, into the oil business.

Test well in Switzerland

In Switzerland, BP Exploration S. A. Fribourg has spudded in its first exploration deep test well in the canton of Fribourg. This well is being drilled by BP under its contract with Societe d'Interets Miniers S.A., and will be known as 1 Courtion. The site is about 10 km. northwest of the city of Fribourg near the village of Courtion.

It is anticipated that a second test well will also be drilled by BP Exploration S.. A. Fribourg.

Alberta wildcat hits Mississippian

In Canada, Amerada Petroleum Corp. came up with an important Mississippian oil find at its Rowley-Morrin wildcat.

A drill-stem test at this South Central Alberta wildcat at 4,445-4,508 ft. got 2,400 ft. clean oil. The 11-15 Rowley, LSD 11, 15-32-20w4, found the Mississippian Pekisko at 4,382 ft.

Snipe Lake. Texaco-Amerada 14-29 Snipe Lake, LSD 14, 29-69-19w5, northeast of South Sturgeon Lake field in Alberta, a former tight hole, found oil in the Triassic. A test at 4,746-71 ft. got 100 ft. of light-brown oil. A test at 4,750-89 ft. got 570 ft. of oil. A test in the Fernie zone got 450 ft. of low-gravity oil. Top of Fernie was 4,542 ft. Test was at 4,553-78 ft.

The group immediately drilled an offset 2¼ miles northeast, but this well was dry. The play is about 12 miles northeast of D3 oil at Sturgeon Lake and 30 miles north of Beaverhill Devonian oil at Kaybob.

Major oil find for Central Alberta

A major oil discovery is reported at Morinville in Central Alberta. The discovery well is C. P. McGaha et al. 4-19-54-25 Morinville on LSD 4, 19-54-25w4, 7 miles northeast of Acheson Devonian oil field. Flow was 600 bbl. per day from perforations in the Cooking Lake zone at 5,329-47 ft. Flow was through ½-in. bottom-hole choke.

The McGaha-Samedan well is located 6 miles northwest of Edmonton. There is an estimated 20-ft. pay section. The flow was from a 7-ft. section, however.

Deep gas production for Arkansas' Crawford

Deeper gas production is being opened northwest of the old shallow-sand Kibler field in Crawford County, Arkansas.

The new discovery is by Ambassador Oil Corp. in the lower Pennsylvanian Hale sand, perforated at 5,584-5,614 ft. Ambassador's discovery well, 1 Star Greig, has been completed with a flow of 4,256 M.c.f.d. of gas through ¾-in. choke. Its pressure is 360 psi.

Location of the well, in 35-9n-31w, is nearly a mile from the shallow production. It is just southwest of Westville, and east of Van Buren.

The well was drilled to 5,709 ft. into the Mississippian. Log indicated at least five gas sands in addition to the completion zone.

Southern Kentucky has new discovery

In southern Kentucky Pampas Petroleum Co. has completed a new discovery on the Claude Wright farm located approximately 10 miles north of Franklin, in Warren County. Pampas is a wholly owned subsidiary of Consolidated Negus Mines, Ltd., a Canadian mining company with headquarters in Toronto.

Production is approximately 2 bbl. of oil per hour natural with a trace of water. Producing horizon is the Warsaw between depths 400-427 ft. The Warsaw lies above the New Albany black shale which is a common marker between the Mississippian and Devonian periods. The Warsaw in this area can be described as a gray limestone, fossiliferous, and slightly argillaceous with a little chert.

Pampas will study the area further before determining whether well stimulation is necessary or desirable.

Figures released for Michigan field

PRODUCTION figures announced by the State Geological Survey based on proration data credited the Scipio-Pulaski-Albion trend Trenton-Black River field with 647,948 bbl. for the month of May. This compared to estimated total state production in May of 1,310,000 bbl., and 523,870 bbl. for the Scipio area in April this year. Production was from 197 wells over the 36-mile-long play.

By pools, production in May included 352,163 bbl. from Scipio, 189,511 from Albion and 106,274 bbl. from Pulaski.

As of June 1 a 125-bbl. per day per well prorate applied, with the area given an allowable of 637,588 bbl. for June, not including new well completions.

Gerald Eddy, state supervisor of wells, set a 75-bbl. per day per well proration for the new Ferry pool, Oceana County, following hearings June 23 in Lansing. At the same time 20-acre unit spacing was established for the 2,000-ft. pay-depth area. Four

rigs are running with four additional locations staked waiting on rigs.

Flory Drilling Co. 1 Baron, 21-14n-16w, discovery in the Ferry play, completed for 121 bbl. per day at 1,950 ft. in Traverse lime.

Deep pay tapped in Louisiana

ULTRADEEP sands off the north side of the Belle Isle dome in St. Mary Parish, Louisiana, have proved productive in another good well completed by Sun Oil Co.

Pay of the new well is a 10-ft. zone topped at 17,356 ft. It flowed 174 bbl. of 44.7°-gravity oil with 4,105 M.c.f.d. of gas on tests through 10/64-in. choke. Flow was under pressure of 10,500 psi.

This is Sun's second well from 17,-000-ft. sands at Belle Isle. It is just west of the other, 2 Miami, completed a year ago at 17,573-80 ft.

Deep gas test slated for Ohio

A deep test for gas has been staked on 1 M. P. Sayler, Lot 48, 4 Qt., in Florence Township, Erie County, Ohio.

Ohio Fuel Gas Co. has announced a test will be drilled to the Precambrian unless commercial production is found in a shallower formation.

This wildcat is the first step in a planned exploratory program with East Ohio Gas Co. to indicate potentialities of the lease block held by these companies in eastern Erie and Huron, and western Lorain counties.

East Ohio Gas Co. is planning a test in Henrietta Township, Lorain County, the adjacent township, southwest of the Ohio Fuel location.

The wells will be drilled with cable tools by W. H. Patten Drilling Co. and are expected to test formations through the Cambrian at probable total depth of 4,500 ft.

Ohio's Clayton field extended

In Ohio an extension to Clayton field in southeast Madison Township, Perry County, made an initial of 120 bbl. per day with 220 M.c.f.d. of gas after fracturing.

The Clinton sand in the producer, Mid East Oil Co. 1 Hurst & Carrick, Section 27, was logged at 3,360-3,417 ft. and had a showing of oil and gas natural.

• Also in Perry County, Altier Bros. finaled 1 D. W. Harlan and 3 Grace Ream in Section 17, Reading Township as northern extensions to Somerset pool. Both wells were reported as having a flow of 75 bbl. of oil per day after fracturing. The Clinton sand was logged at 3,009-50 ft. and 2,961-3,014 ft. respectively.

New field opens in northwestern Oklahoma

Northwestern Oklahoma's Blaine County has a new producing area. Discovery well of South Watonga field is Texaco Inc. 1 Sallstrom in C SW NE 2-15n-12w.

The well finaled for 4,800 M.c.f.d. and 31 bbl. condensate per million from perforations in the Morrow Pennsylvanian at 9,754-64 and 9,776-88 ft. Other openings were at 9,798-9,807 ft.

Kingfisher County. A new Manning gas well was added to new Southwest Kingfisher field at Apache Oil Corp. 1 Duggan - Bowman in SW SW NE 8-15n-7w. This well flowed 4,735 M.c.f.d. on ¼-in. choke, extending the field 1 mile south of the discovery. Perforations were at 7,870-80, 7,889-91, and 7,898-7,901 ft.

To the north of the field discovery, the 1 Sioux Unit in C NE SW 32-

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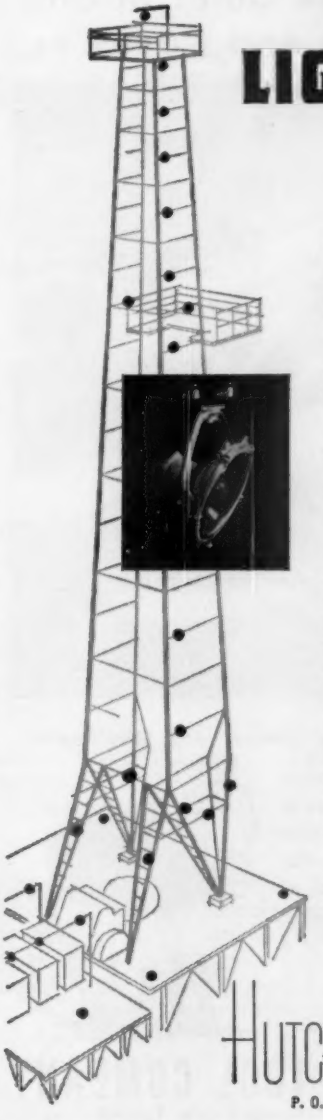

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16n-7w, flowed 1,594 M.c.f.d. from 10/64-in. choke through perforations in the Manning at 7,805-15 and 7,825-48 ft. It then flowed 2,694 M.c.f.d. on ¼-in. choke.

Kingfisher sets pace for Oklahoma drilling

DEVELOPMENTS in Oklahoma's Kingfisher County continue to lead drilling interest in that state.

Ohio Oil Co. completed 1 Vogt in C SE NW 29-15n-7w as the fourth producer in North Okarche field. The Manning Mississippian zone made 8,100 M.c.f.d. from perforations at 8,160-72 and 8,176-78 ft. Carter Division of Humble Oil & Refining Co. gaged the Manning at 1 Huntsberger in North Hennessey field, C NW SW 11-19n-7w. The well flowed 24 bbl. condensate and 18 bbl. acid water in 24 hours through ¼-in. choke and 1,800 M.c.f.d.

Other activity includes a new 7,100-ft. test on the east side of North Dover field. Carter will drill 1 Patterson in C SW NW 13-18n-7w with Nuckolls-Bell Drilling Co. holding the Manning contract.

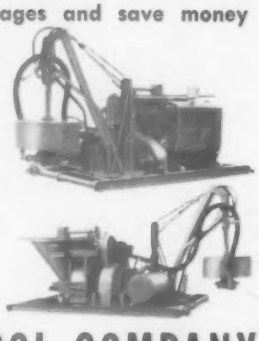
Apache Oil Corp. gaged 1 Sioux Unit in C NE SW 32-16n-7w, north of the Southwest Kingfisher pool discovery well. The treated zone flowed 3 M.M.c.f.d. through 20/64-in. choke from perforations in the Manning at 7,805-48 ft. This well also is a Layton producer at 6,450-60 ft. It swabbed 10-12 bbl. of oil hourly after treatment.

Jones and Pellow Oil Co. 1 Crossley in C NE NW 14-18n-7w, North Dover pool, swabbed 155 bbl. of oil in 24 hours through perforations in the upper Manning at 6,909-20 ft. The well then flowed 176 bbl. per day on 18/64-in. choke.

New Mudmixer Makes Other Mixing Methods Obsolete and Costly

Compare Thompson's field proved advantages and save money

Automatic feed and mixer gives close control of dry muds and chemicals (except caustic soda) and mixer delivers mud to system thoroughly mixed. Actual field tests have proven an *increase in jel yield of 15% to 30%* over hand feed and jet mixing methods. Thompson Mud and Chemical Mixer is a complete unit with pump and power.



SOLD ONLY THROUGH SUPPLY STORES

THOMPSON TOOL COMPANY
Iowa Park, Texas

Good well extends West Enville in Oklahoma

Southern Oklahoma's West Enville field, Love County, was extended by Sinclair Oil & Gas Co. at 1 Westheimer in C NE SW 30-6s-3e. The well flowed 151 bbl. of condensate per day through 7/64-in. choke and 1,345 M.c.f.d. from basal Oil Creek Ordovician sand at 11,200-98 ft. Previously, this well had flowed 18,800 M.c.f.d. on 5-hour test through ¾-in. choke.

In the area between Madill and Aylesworth field, Marshall County, Sinclair 4 Dilley in C W½ NW SW 32-5s-6e, found dry gas at 3,804-14 ft. in McLish Ordovician sand. The well flowed 2,484 M.c.f.d. through 24/64-in. choke, 3,500 M.c.f.d. through 30/64-in. choke, and 4,560 M.c.f.d. from 34/64-in. choke.

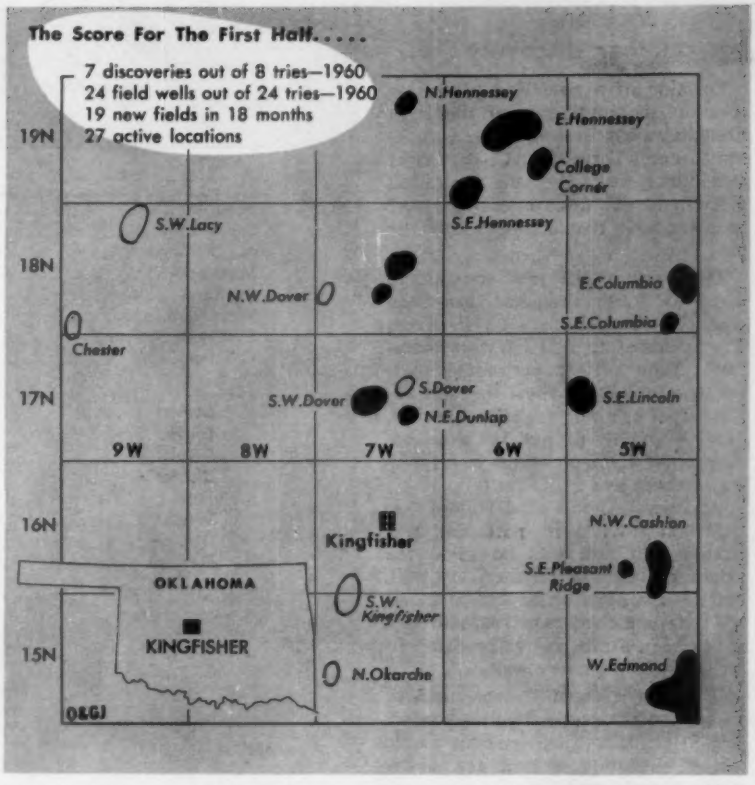
Exploratory well in South Texas has good gas-condensate production

Good gas-condensate production has been found in an exploratory test west of Falfurrias, in northern Brooks County, South Texas. The new area is off the south flank of the multiple-pay LaGloria field where extensive cycling operations have been carried on many years.

The discovery is by Coastal States Gas Producing Co. in its 1 Carmelia Adair with production from Frio sand at 7,846-68 ft. The well is rated good for 13,500 M.c.f.d. of gas, recovering 20 bbl. of 54.6°-gravity condensate per M.M.c.f. Shut-in pressure is 3,442 psi.

LaGloria field, discovered in 1945, has more than 320 wells with production from more than 20 separate zones and reservoirs. Spread out over a large area of southern Jim Wells and northern Brooks County, it is virtually contiguous with the vast Tijerina-Canales-Blucher and Seeligson fields.

Oklahoma's Kingfisher blossoms with success



HERE IS the busiest single county area in the entire Mid-Continent region—Oklahoma's Kingfisher where oil vies with wheat for regional interest.

ABOUT 5 MONTHS AGO this column stated "Oklahoma's Kingfisher County looms as a 1960 hot spot." This prediction not only came true, but explorers have come up with one of those success ratios that drillers dream about—100% for field-well development drilling, 87½% for wildcatting. With 7 new fields tapped this year, 24 field wells completed successfully, 19 new fields in the past 18 months, and 27 rigs working right now, this West Central Oklahoma county is at the top of the nation's busy oil arenas this year.

The target is Mississippian

... as wildcatters from more than 10 different companies move into what is fast becoming one of Oklahoma's major new oil areas. This county is one of those bypassed in recent oil-hunting years. It lies just west of the prolific and well-known Nemaha ridge fields like West Edmond, Crescent, Lovell, etc., but it wasn't until about 18 months ago that things really got moving in Kingfisher.

As a result of the tremendous success in Kingfisher County drilling this year, the Manning zone of Upper Mississippian Chester age has become one of Soonerland's most promising pay prospects. This pay extends east and south out of Major County and its big Ringwood field into and across Kingfisher County, exposing what appears to be a major stratigraphic trap that swings south parallel to the Nemaha ridge.

But others are in the play

... since Manning isn't the only objective in this fired-up Kingfisher campaign. The Meramec and Oswego, of Mississippian and Pennsylvanian age, respectively, as well as the Mississippi lime are getting some action in current drilling.

Eason Oil Co. recently completed 1 Petru in East Hennessey field flowing 4 bbl. of oil hourly from the Meramec, as well as good oil flows from the Manning. Jones and Pellow 1-C Schimanek flowed 280 bbl. of oil in 12 hours from Manning, but also flowed good amounts from the Meramec. Carter's 1 Houghton flowed 59 bbl. of oil from Oswego as well as 227 bbl. from the Manning.

There seems to be no end

... to the busy drilling spree enjoyed by this candidate for Oklahoma's most successful oil-hunting county for 1960. With wells like Carter's 1 Crossley in North Dover field (flowed 1,188 bbl. of oil per day from the Manning), 100% success ratios in field-well drilling, and seven out of eight wildcat hits, Kingfisher will have myriad new green splotches on its oil maps by the end of the year. The impressive acreage spread and a lot of land yet to drill will keep the area's operators busy for the last half of 1960 and well into next year. Expansion work is daily adding producers in North Dover, East Hennessey, and Southeast Lincoln pools. There are also stepouts going in Northeast Dunlap and North Hennessey fields. When the last tally is in in December, the accompanying map should be a lot more solid black than it is now.

—John C. McCaslin

Texas' Jackson has another discovery

Opening of a new Frio producing area off the south side of the large Francitas field in southeastern Jackson County, Texas Gulf Coast, marks a continuation of the long succession of oil and gas discoveries that have been made in that county within the past year.

Discovery of the new area, designated as South Francitas, has been credited to Texaco Inc.'s 4 J. F. Weed. It was drilled to 9,312 ft., and completed from a 10-ft. perforated interval at 8,960-70 ft. Flow through adjustable choke was gaged at 178 bbl. of 42.8°-gravity oil per day with gas-oil ratio of 4,950 cu. ft. per bbl. Flowing pressure was 2,737 psi.

Another Texaco well, 1 Hillard Gas Unit, only 1,100 ft. northeast, was started first and was down to the producing depth before the Weed well, but it was drilled on to 10,500 ft. As yet it has not been completed although it has been a prospective producer as the possible discovery well.

The area is about 3 miles south of the town of Francitas. Nearest production in Francitas field is about a mile distant. Location is near the Matagorda County line.

New Louisiana find is productive

Another in-between spot in South Louisiana's dense array of oil and gas fields has proved productive in a new discovery by F. A. Callery, Inc., in much-drilled Iberville Parish.

It is about midway in the 4½-mile gap between Bayou Plaquemines and Sullivan's Lake fields, and about 2½ miles southeast of the Bayou Bleu field.

Callery's discovery well, 1 A. Wilbert Sons Lumber & Shingle Co., flowed 120 bbl. of 32.1°-gravity oil per day when tested through 6/64-in. choke. It had flowing pressure of 1,250 psi., and gas-oil ratio of 709 cu. ft. per bbl. Pay is open through perforations at 10,112-16 ft.

Bayou Bleu is one of the early geophysically discovered piercement-type salt domes, on and around which production has been found in a multiplicity of sands and segments.

Good Morrow oil well completed in Panhandle

The 1 Lehman, an upper Morrow Pennsylvanian sand oiler in East Camrick field, Beaver County, Oklahoma Panhandle, flowed 150 bbl. of oil in 8 hours through 1-in. choke or 450 bbl. per day from perforations in the Morrow from 7,164 to 7,200 ft. The well is a Carter Division of Humble Oil & Refining Co. project.

At Dower field, Carter 2 Sager, C SW SW 35-1n-20eCM, swabbed 260 bbl. of oil in 8 hours from perforations at 7,756-91 ft. Flow of gas was 1,930 M.c.f.d.

In the link area between Mocane and Northeast Forgan fields, Pioneer Production Co. found gas in the Chester Mississippian lime at its 1 Girk in NE NE SW 34-6n-24eCM. The well flowed 2,350 M.c.f.d. from 6,232-85 ft.

Suspended Wyoming well to be retested

A Fort Union Tertiary and Lance Upper Cretaceous well in Sublette County, Wyoming, suspended in March of last year, will be retested. It is G. L. Reasor's 1 Government-Reasor in SE NE 28-27n-103w.

The estimated potential before the operator suspended operations last year was 4 to 5 M.M.c.f.d. Fort Union-Lance was topped at 7,590 ft. There were perforations in four sets of zones between 9,334 and 9,570 ft. The well also flowed 1 to 3 M.M.c.f.d. from Mesaverde Cretaceous at 12,940-58 ft.

The Reasor well is the second on the Pacific Creek block, the first being Superior Oil Co.'s 1949 dry, 20,521-ft. 1 Unit well, then the world's deepest hole. The last top at that well was Frontier Cretaceous at 19,720 ft. There were several gas shows in Mesaverde and deeper rocks.

Utah's Northwest Lisbon becomes "Lisbon field"

The Utah Oil and Gas Conservation Commission has officially tagged Pure Oil Co.'s 1 Northwest Lisbon discovery in San Juan County "Lisbon pool." Definition of the field is as follows: W½ 2, all 3, E½, E½ W½ 4; E½ W½ 9; all 10; W½ 11; N½ NW 14; N½ N½ 15 and NE NW, N½ NE 16-30s-24e. The discovery well had Devonian oil production and commercial gas-condensate showings in the Mississippian. There are now four wells in the field with production from both zones.

Wyoming's Patrick Draw notes thirtieth location

El Paso Natural Gas Co. staked the thirtieth location at Patrick Draw Unit field in Sweetwater County, Green River basin, Wyoming.

(Continued on page 172)

May Multiple Completions in U. S.*

	Dual	Triple	Quadruple	Sextuple
Arkansas	—	—	1	—
S. Louisiana	19	2	—	—
La. Offshore	7	3	—	—
Mississippi	2	—	—	—
Montana	1	—	—	—
West N. M.	5	—	—	—
East N. M.	5	—	—	—
Oklahoma	16	—	—	—
Texas	50	2	—	1
District 1	—	—	—	—
District 2	7	—	—	1
District 3	6	—	—	—
District 4	9	1	—	—
East	5	—	—	—
West	14	1	—	—
Dist. 9	7	—	—	—
Dist. 10	2	—	—	—
Total U. S.	101	7	1	1

*Revised.

STATEMENT OF CONDITION

At the close of business . . .

June 15, 1960

RESOURCES

Cash and Due from Banks	$111,331,587.07	
U. S. Government Securities	64,634,998.15	
Other Bonds and Warrants	10,129,879.13	$186,096,464.35
Loans and Discounts		95,338,796.81
Income Receivable Accrued		481,730.78
Stock in Federal Reserve Banks		420,000.00
Bank Premises		4,104,063.33
Customers' Liability Under Letters of Credit		456,772.00
		$286,897,827.27

LIABILITIES

Deposits		$253,621,362.24
Letters of Credit Outstanding		456,772.00
Income Collected, not earned		569,922.65
Reserve for Taxes, Interest, Etc.		1,005,272.59
Bills Payable		10,000,000.00
Capital—Common	$ 5,750,000.00	
Surplus	8,250,000.00	
Undivided Profits and Reserves	7,244,497.79	21,244,497.79
		$286,897,827.27

NATIONAL BANK OF TULSA

OIL BANK OF AMERICA

Member Federal Deposit Insurance Corporation

Latin American Specialist

. . . is Jorge Mejia, who'll be in charge of all operations in Pacific half of South America for Mobil International.

FEW OIL MEN have a more intimate knowledge of the Latin American oil industry than Jorge Mejia, regional executive for Latin America for Mobil International Oil Co.

Mejia, a 47-year-old Colombian, makes full use of his background as the man responsible for Mobil International's day-by-day operations on the western side of South America, including Colombia, Chile, Ecuador, Peru, and in Argentina and the Central American republics.

While he has expert advice available on any specific question, ultimate responsibility for all operations in his area, from exploration through marketing, rests with him. This is under Mobil's reorganized management setup, which divides responsibility for Latin America along geographical lines, rather than by function. Mejia is one of two regional executives for Latin America responsible to a Mobil International vice president.

Mejia's headquarters are now in New York City. But he expects to visit each country in his area of operations once or twice a year.

Jorge Mejia
. . . chose oil rather than coffee.

Son of "Mr. Coffee" . . . Mejia was born at Manizales, Colombia, the son of the late Don Manuel Mejia and Da. Cecilia Salazar de Mejia. His father was known internationally as "Mr. Coffee" and was president of Federacion Nacional de Cafeteros de Colombia for 21 years.

Young Jorge's family moved to New York when he was 9. He attended De La Salle Institute in Manhattan for 4 years, which may account in large part for the faultless English he now speaks. In his high school years he was back in Colombia, where he attended the Gimnasio Moderno de Bogota.

Mejia does not know why a career in oil appealed to him more than the coffee business. But he was interested in engineering, and there was excitement in Colombia about the future of oil.

He returned to the U. S. to attend the University of California, where he obtained a degree in petroleum engineering. Rowing appealed to him, and he made the varsity crew as No. 2 oar.

A start in oil . . . He started in the oil business strictly on a ground-up basis. His first job was shoveling mud in ditches for North Dome Association during a summer vacation from college.

He joined the Mobil organization in Colombia in 1934 as a field engineer, where he got up early and worked hard. He worked in the geological and land departments of Mobil de Colombia, became field superintendent of Cantagallo field in 1941, and served as assistant general manager in Bogota from 1942 to 1951.

He left Mobil to become general manager of Raymond Concrete Pile Co. de Colombia from 1951 to 1957, where he supervised such projects as Neusa Dam, expansion of Buenaventura Port, and improvement of the Cali-Medellin road.

His career with Raymond Concrete was abruptly interrupted by the revolution that overthrew the Colombia dictatorship. On the day the government fell, he and other prominent Colombians were ordered over the radio to appear that afternoon before the military leaders of the revolution. No explanation was given. He kept the appointment, and was told that he was to be the minister of agriculture.

He served in the cabinet during 1957 and 1958, until after a democratic government was established by

▶▶▶ Personals

John R. Sherman, assistant manager of Warren Petroleum Corp.'s manufacturing division, has been promoted to division manager. He succeeds **C. W. Miller,** now vice president in charge of manufacturing.

P. W. Judah, manager of Socony Mobil Oil Co.'s petroleum chemicals department, has been named manager of the basic petroleum chemicals division and the paint and special products division of Mobil Chemicals Co.

Dr. Herschel H. Cudd, vice president of research and development for American Viscose Corp., has been named president of AviSun Corp. He succeeds **Chalmer G. Kirkbride,** Sun Oil Co.'s vice president, research and engineering. AviSun is jointly owned by American Viscose and Sun Oil.

Ira A. Wyant, production geologist with Shell Oil Co. in Oklahoma City, has been promoted to division production geologist and transferred to Centralia, Ill.

John M. Shea, Jr., manager of marketing for American Petrofina, Inc., and **Ralph E. Damp,** manager of production and exploration, have been elected vice presidents and directors. Shea will continue as vice president, marketing, for American Petrofina Co. of Texas, an operating subsidiary.

W. C. Stout, manager of Continental Oil Co.'s headquarters land section in Houston, has been promoted to coordinator of reserves and production acquisitions, a new position. Stout was southern region exploration manager before his land section appointment.

William A. Romeiser, industrial products manager in Sun Oil Co.'s middle Atlantic sales region, has been named general manager of the industrial products department in Philadelphia. He succeeds **Francis F. Palmer,** recently named retail sales manager in the Ohio Valley sales region. **Robert C. Brady,** special representative in the industrial products department, has succeeded Romeiser.

election. He was responsible in this period for the introduction of a number of basic agricultural reforms, including legislation dealing with agricultural development, farm credit, irrigation, and fisheries. After leaving public life, he rejoined Mobil as regional economist for Latin America in 1959.

Colombia continues to be one of the places of chief interest to Mejia. Mobil has a large marketing organization there, and is half owner in Colpet, the largest crude producer in the country, with an average of about 60,000 bbl. daily.

In Peru, he is especially concerned at present with a new lubricating-oil plant under construction, and with a two-well wildcatting program planned for next year. The wells, to be drilled in the Montana region of eastern Peru, will be the first by Mobil in the entire country.

Looking ahead . . . Mejia believes the Latin American oil industry is far too big, widespread, and complex to make any generalities about it. If Latin America wants to develop its oil resources, individual governments will have to recognize the competitive condition of the crude producing industry in the world today.

On the other hand, markets are growing rapidly. Demand is increasing 8 to 10% per year in Argentina, Brazil, Colombia, and Peru—and even faster in Venezuela.

The well-known Colombian has served as a board member of several important business enterprises in his country. He has been a director of Banco de Bogota since 1946. Mejia and his wife, the former Julia Hernandez, reside in Greenwich, Conn. They have five children.

Hanford Morris, assistant district engineer in Wichita for Texaco Inc., has been promoted to field foreman in Ardmore, Okla.

Philip H. Rider, assistant engineering and operations manager in Tidewater Oil Co.'s marketing department, has been appointed assistant manager of the transportation and supply department.

John C. Weidman, New York regional manager for Sun Oil Co., has been elected chairman of the executive committee of New York State Petroleum Council. He succeeds **Ralph F. Glock,** Richfield Oil Corp. of New York. **Ralph C. Davis,** California Oil Co., has been elected vice chairman of the executive committee.

A. T. Hinson, sales supervisor for Monsanto Chemical Co., has been appointed product manager, petroleum chemicals, for the overseas division in St. Louis.

Frederick P. Glazier has joined Sun Oil Co. as special assistant in the research and development division. He will be principal liaison for Sun with automotive and aviation industries.

Ralph W. Collins, manager of Midwest Oil Corp.'s production department in Denver, has been appointed vice president in charge of the production department. Collins was assistant to the vice president of the old Pan-Am Southern Corp. before joining Midwest in 1954.

D. G. Proudfoot, vice president of Pennzoil division, South Penn Oil Co., has retired. Proudfoot is a former chairman of API's lubrication committee and a former vice chairman of the fuel and lubricants technical committee of Society of Automotive Engineers.

Charles M. Gambrill, analytical coordinator, research labs, for Ethyl Corp., and **Robert R. Thurston,** Jenson Beach, Fla., consultant, received American Society for Testing Materials' awards of merit last week during ASTM's annual meeting. Thurston retired in 1958 as assistant manager, technical service division, in the research and technical department of Texaco Inc.

H. F. Nelson has been appointed assistant to the general sales manager, western division, for Sinclair Refining Co. in Kansas City. **R. R. Phillips,** assistant western division manager, will succeed Nelson as western division manager. **R. G. Griffin,** Kansas City district manager, will succeed Phillips. **B. L. Gay,** assistant district manager in Kansas City, has moved up to succeed Griffin. Gay will be succeeded by **R. J. Beddingfield,** branch manager for metropolitan St. Louis. **J. M. Juett,** assistant branch manager for metropolitan St. Louis, has succeeded Beddingfield. **D. G. Bechtel,** special sales representative in the St. Louis district, has replaced Juett and **G. C. Godwin,** sales representative, general St. Louis district, has succeeded Bechtel. Also, **W. H. Noyes** has been named manager of wholesale sales for the western division succeeding **O. M. Ogden,** who has retired.

▶▶▶ Personals

G. H. Calhoun, mechanical engineer with Shell Oil Co., has been transferred to Midland, Tex., from Wichita Falls.

Ashley M. Houghton, engineering trainee with Richfield Oil Corp., has been promoted to development engineer and transferred to New Cuyama, Calif., from Bakersfield.

Edward N. Leibacher, vice president and a director of Standard-Vacuum Oil Co., has retired after 44 years with the company and its affiliates. Leibacher had served as general manager in Indonesia and coordinator of Indonesian affairs in New York before being named a director in 1951.

R. Cody McPherson, Calgary, senior vice president of Canadian Natural Gas Co., Ltd., has been elected president of Canadian Gas Association. He succeeds **N. E. Tanner,** president of Merit Oil, Ltd. **Okah L. Jones,** Consumers' Gas Co., has been named first vice president of the association. **J. W. Ostler,** Canadian Meter Co., Ltd., is second vice president.

FELDMAN

Karl T. Feldman, part-interest executive for Sinclair Pipe Line Co., Independence, Kans., has been elected a director of Great Lakes Pipe Line Co. He succeeds **James E. Dyer,** vice chairman of Sinclair Oil Corp. on the Great Lakes board.

David H. Finnie, joint-venture coordinator for Mobil International Oil Co.'s interests in Iraq, has been named alternate director in London for Mobil's interests in Iran. He replaces **William Tatge,** who has been named director of relations for Mobil in Libya. **Ronald F. Dick** will succeed Finnie in New York.

A. V. Brashear, vice president and manager of operations for Michigan Consolidated Gas Co., has been elected president of the Michigan Gas Association. **Frank B. Adams,** Consumers Power Co., has been named vice president, and **Milton G. Kendrick,** Michigan Consolidated, has been reelected secretary and treasurer. **Karl Schmidt** and **Albert F. Mullins,** both of Michigan Consolidated, have been elected directors of the association.

Personals

John D. McPherson, executive vice president of Jefferson Chemical Co., Inc., has been elected president and a director. He succeeds **George R. Bryant,** who will retire July 31. McPherson joined Jefferson Chemical in 1955 as vice president, operations. He was elected executive vice president in 1958. Bryant was a vice president of Texaco Inc. before being elected president and a director of Jefferson Chemical in 1955. The chemical company is jointly owned by Texaco and American Cyanamid Co. In other Jefferson Chemical changes, **Claude E. Luke,** assistant unit supervisor of the chlorine-caustic unit at the Port Neches, Tex., plant, has been named production supervisor of the Conroe, Tex., plant. **Prem S. Advani,** process engineer, has been named technical supervisor in Conroe.

McPHERSON

George R. Benz, manager of engineering for Phillips Petroleum Co., has been installed as president of Oklahoma Society of Professional Engineers. **W. R. Clarke,** Jones & Laughlin Supply division, is president-elect. Other officers are **William J. Collins,** Oklahoma City consultant, vice president; and **Ralph Randall,** Engineering for Industry, Inc., Oklahoma City, secretary-treasurer.

David M. Saenger has been named senior technical sales representative in Oronite Chemical Co.'s new petroleum and rubber chemicals division. He will headquarter in New York. Saenger had been with California Research Corp. for 14 years before the new appointment. Both companies are subsidiaries of Standard Oil Co. of California.

Ralph L. Cormany, Signal Oil & Gas Co., Los Angeles, has been elected president of the American Association of Petroleum Landmen. He succeeds **M. W. Hankinson,** Humble Oil & Refining Co., Houston. Other officers include **George R. Bixler,** BBM Drilling Co., Houston, first vice president; **Emmett Williams,** Cities Service Oil Co., Roswell, N. M., second vice president; **E. E. Gilbert,** Sun Oil Co., Calgary, third vice president; **Dudley Couvillon,** Standard Oil Co. of California, San Francisco, treasurer; and **Ken Cook,** Richfield Oil Corp., Los Angeles, secretary.

Ernest D. Anderson has joined the staff of the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.). He will study the effect of newly developed lubricating oils on automotive engines.

Robert P. Lucas and **Boris S. Voukovitch,** formerly with Geophoto Services, Inc., have formed Lucas-Voukovitch, consulting geological firm in Denver. They will specialize in foreign exploration.

Amos K. Smith has been appointed coordinator of marketing, supply, and distribution in the Chicago general office of Standard Oil Co. (Ind.). He had been manager of the sales promotion and sales training department.

Frederick S. Johnson, junior geologist for Sinclair Oil & Gas Co. in Denver, has been transferred to Casper, Wyo. Johnson has been with Sinclair since 1956. He moved to Denver from Billings, Mont., earlier this year.

Ernest T. Robinson, Jr., general superintendent of gas operations for Texas Eastern Transmission Corp., has been promoted to vice president in charge of gas operations. He succeeds **E. R. Cunningham,** who has retired. Robinson has been with Texas Eastern since 1947. He will continue to headquarter in Shreveport, La.

Charles M. Baker, Continental Oil Co., has been named president of the Corpus Christi, Tex., Geological Society. He succeeds **W. R. Ledbetter,** Texaco Inc. Other new officers are **Dale R. Olson,** Pure Oil Co., first vice president; **J. V. McCullough,** Carrl Oil Co., second vice president; **Mary C. Magaw,** Shell Oil Co., secretary; and **Fred M. Thompson, Jr.,** Houston Natural Gas Production Co., treasurer. Councilors will be **Arthur J. Tschoepe,** Cosden Petroleum Corp., and **Richard R. White,** Southern Minerals Corp.

Richard C. Shower has been named cost and economics analyst for Goodrich-Gulf Chemicals, Inc.

Ronald Jacobs, district staff engineer for Sunray Mid-Continent Oil Co. in Corpus Christi, Tex., has joined Skelly Oil Co. in Tulsa as proration engineer.

David P. Bossler, reservoir engineer in Jersey Production Research Co.'s production division, Tulsa, has been transferred to Imperial Oil Ltd. in Calgary as reservoir engineer. He had been on temporary assignment with Imperial since January 1.

John M. Brown, refinery manager for Lake Superior Refining Co., has been elected a director. He succeeds **Edwin F. Nelson,** former president, on the board. Brown also has been elected a vice president and general manager of the company. Nelson, who retired July 1, has been succeeded as president by **L. Russell Marks,** executive vice president of Murphy Corp., the parent company, and a director of Lake Superior. Nelson will continue as a consultant to Lake Superior. Brown has been refinery manager for the company since last year. He was manager of American Oil Co.'s El Dorado, Ark., refinery before joining Lake Superior.

BROWN

D. C. Wixon, administrative vice president of DX Sunray Oil Co., has been named administrative vice president for the Sunray companies—Sunray Mid-Continent Oil Co. and its principal subsidiaries, DX Sunray and Mid-Continent Pipe Line Co. He will take over a variety of administrative responsibilities which have been handled by other officers.

Deaths

Hugh Simmons, 65, retired head of Sinclair Oil & Gas Co.'s gas accounting department, died June 28 in a Tulsa hospital after a heart attack. Simmons retired last year after 40 years with Sinclair.

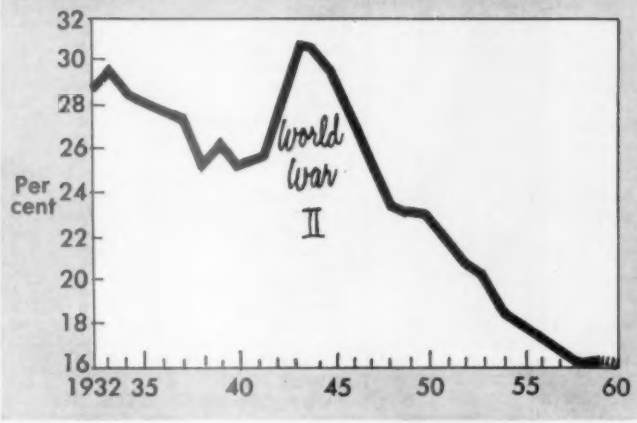
Robert Lee Howington, 70, geologist for Shell Oil Co. in Los Angeles, died June 19.

Robert Addison Reed, 90, retired Sapulpa, Okla., oil man, died June 28 at his home after a long illness. Reed was production superintendent for Clarence E. Roth, Independence, Kans., operator, for many years. He retired in 1940.

Clyde Hudson Dorr, 67, Oklahoma City consulting geologist, was killed in an auto accident June 24 near Chandler, Okla.

Eugene Vincent Carlin, 81, retired Tulsa independent operator, died June 28 in a Tulsa hospital. He had been ill for several months.

RESIDUAL FUEL PORTION OF TOTAL DOMESTIC OIL DEMAND



Since residual demand has not kept pace with demand for other petroleum products, increased imports of residual have not offset the decreased yield of this product at domestic refineries.

Coal didn't lose its market to residual

BY JOHN C. CASPER

DEMAND for residual fuel is growing at a slower rate than other products made from crude. In fact, it hasn't grown at all in recent years.

Domestic demand for residual averaged 1,531,000 bbl. daily last year or almost exactly the same as the average for the 4-year period 1950 through 1953.

Domestic demand for all products averaged 7,111,000 bbl. daily for 1950-53 but had climbed to 9,451,000 bbl. daily last year. This represents a gain of 32.9%.

The same comparison for a longer period of time is shown by the line on the above chart. Residual fuel accounted for a little better than 29% of total domestic demand in 1932, the first year the Bureau of Mines reported residual and distillate fuels separately.

There was a steady decline in the residual portion until the start of World War II. The peak on the chart covering the war years resulted from two prime factors.

1. Wartime increases in industrial production jumped the need for industrial fuels of all kinds.

2. Limitations on civilian use of both gasoline and distillate fuels tended to restrict the growth rate for oil as a whole.

Under this restriction of total consumption and expansion in use of heavy fuel, residual's portion of total demand climbed to 30.7% for 1943. The ratio dropped steadily from that peak to the 16.02% reported for 1958.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,812,000	DOWN	16,000	DOWN	203,000
Crude stocks	258,957,000	UP	54,000	DOWN	6,772,000
Completions	916	UP	69	DOWN	112
Refinery runs	8,231,000	UP	197,000	UP	395,000
Gasoline stocks	203,242,000	DOWN	1,130,000	UP	4,971,000
Kerosine stocks	27,583,000	UP	700,000	UP	370,000
Distillate stocks	106,691,000	UP	3,646,000	DOWN	9,300,000
Residual stocks	40,592,000	UP	713,000	DOWN	13,248,000
Four-product stocks	378,108,000	UP	3,929,000	DOWN	17,207,000
Total imports	1,626,100	UP	112,600	DOWN	32,500

Last week's chart showed that this slowing down in demand for heavy fuel was met by reducing the amount of residual made from the average barrel of crude. Refiners cut residual yield from 29.2% of the barrel in 1943 to 11.8% in 1959 (OGJ, June 27, p. 211).

The refiner's cut in percentage yield was greater than the cut in demand. Increased imports made up the difference.

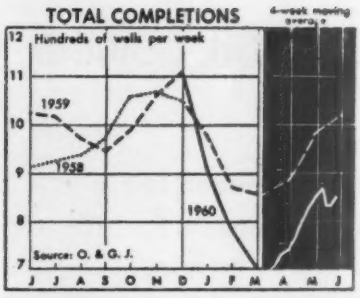
These trends show that the crude producer is the only one who can blame his production loss on residual imports. And in the producers' case, domestic crude prices would have been even lower than they are today if the refiner had continued the old yield pattern of 25% residual.

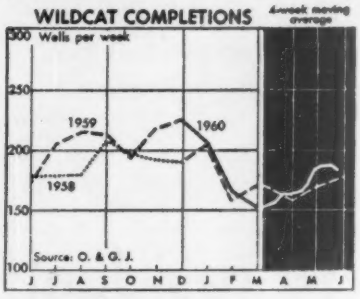
In general, the over-all loss of industrial markets for bituminous and anthracite coals can't be charged to residual fuels, whether made at domestic refineries or imported.

Total industrial uses of coal, gas, and oil can't be compared directly since competition is not uniform in all industrial uses. Coal and oil competed for the railroad market in past years, but gas could not be used. Blast-furnace coke accounted for a large part of total coal consumption with little or no competition from oil and gas.

Major industrial competition is at stationary power plants. Coal still ranks first as an energy source in the fields where oil, gas, and coal compete. It has dropped slightly in its percentage position with the shift to gas, but there is nothing to indicate a loss to heavy fuel. Resid supplies less of the common industrial market than it did in 1950 (OGJ, July 29, 1959, p. 145).

DRILLING





Active Rotary Rigs

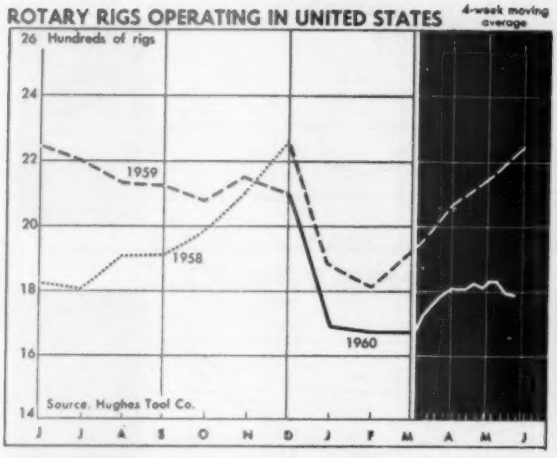
	6-27-60	6-20-60	6-29-59
Alabama	4	5	9
Alaska	4	4	(†)
Arkansas	14	12	13
Arizona	1	1	2
California	87	80	100
Land	81	75	95
Offshore	6	5	5
Colorado	29	25	44
Florida	2	2	2
Land	2	2	1
Offshore	0	0	1
Illinois	39	39	47
Indiana	9	7	6
Iowa	0	0	3
Kansas	120	93	154
Kentucky	4	7	9
Louisiana	295	296	373
North	36	43	36
S. Inland waters	110	107	157
S. Land	93	91	128
Offshore	56	55	52
Maryland	0	0	0
Michigan	44	47	26
Mississippi	58	58	75
Missouri	2	2	1
Montana	17	21	23
Nebraska	28	24	34
Nevada	0	0	1
New Mexico	114	124	124
New York	0	0	1
North Dakota	16	18	27
Ohio	6	7	4
Oklahoma	192	180	242
Pennsylvania	13	12	10
South Dakota	0	0	3
Tennessee	0	0	1
Texas	574	602	764
S. Inland waters	4	4	5
S. Land	168	171	203
Offshore	1	1	1
North	55	55	159
Panhandle	41	41	(*)
East	56	64	(*)
West Central	156	166	246
West	93	100	150
Utah	29	31	34
Washington	0	0	1
West Virginia	5	6	9
Wyoming	65	57	95
Total U. S.	1,771	1,760	2,237
Western Canada	155	165	139
Eastern Canada	2	2	0
Grand total	1,928	1,927	2,376

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

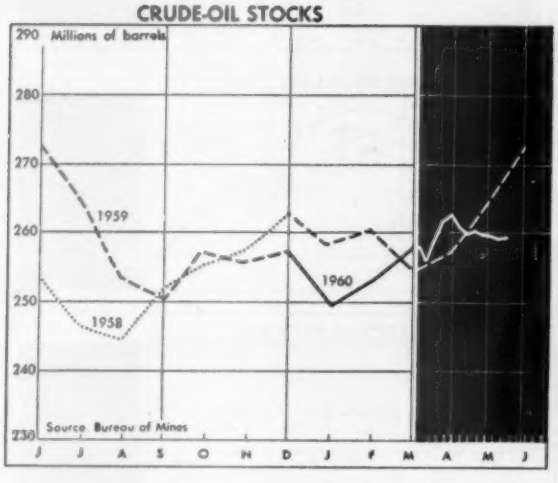
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 25, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	2	2	0	0	0	0	23,163	25	47	0	0	0	0	0	1	9
Arizona	0	0	0	0	0	0	0	8	.....	0	0	0	0	0	8	....
Arkansas	12	5	0	0	7	0	40,339	293	399	2	0	0	0	2	76	63
California	22	20	0	2	0	0	97,892	690	742	0	0	0	0	0	137	172
Colorado	12	1	0	2	9	0	66,288	298	356	9	0	0	1	8	143	212
Illinois	64	16	0	0	31	17	113,105	963	1,014	13	1	0	0	12	221	167
Indiana	17	6	0	0	11	0	22,825	452	367	4	0	0	0	4	172	124
Kansas	80	38	0	0	42	0	280,814	1,588	1,959	24	2	0	0	22	520	443
Kentucky	19	5	0	0	14	0	26,696	762	1,158	3	0	0	0	3	90	73
Louisiana	74	30	4	5	35	0	523,636	1,632	1,714	19	1	1	0	17	249	213
North	37	12	0	5	20	0	137,743	554	623	11	1	0	0	10	112	86
South	28	13	4	0	11	0	286,418	821	908	7	0	1	0	6	120	120
Offshore	9	5	0	0	4	0	99,475	257	183	1	0	0	0	1	17	7
Michigan	11	4	0	1	6	0	36,299	361	293	1	0	0	0	1	108	68
Mississippi	12	3	0	0	9	0	118,332	354	312	6	0	0	0	6	124	146
Montana	10	4	0	0	6	0	39,477	139	141	6	0	0	0	6	64	50
Nebraska	14	6	0	0	8	0	77,022	384	389	6	1	0	0	5	150	173
New Mexico	37	15	0	9	13	0	161,175	888	911	10	1	0	0	9	130	109
West	17	4	0	9	4	0	65,060	289	406	4	0	0	0	4	28	32
East	20	11	0	0	9	0	96,115	599	505	6	1	0	0	5	102	77
New York	10	0	0	3	7	0	33,371	161	110	10	0	0	3	7	21	13
North Dakota	5	2	0	0	3	0	30,376	147	247	2	0	0	0	2	34	48
Ohio	37	20	0	6	11	0	76,335	493	462	1	0	0	0	1	27	13
Oklahoma	99	40	0	10	42	7	364,428	1,890	2,811	19	1	0	0	18	372	427
Pennsylvania	65	19	0	22	7	17	201,127	311	261	1	0	0	1	0	8	4
South Dakota	0	0	0	0	0	0	0	15	.....	0	0	0	0	0	6	....
Texas	287	160	14	10	97	6	1,224,782	7,716	9,281	49	2	2	1	44	1,540	1,713
Dist. 1	11	5	0	1	5	0	47,079	524	551	5	0	0	0	5	194	153
Dist. 2	10	3	2	1	4	0	61,145	370	396	1	0	0	0	1	88	112
Dist. 3	15	6	0	1	8	0	96,947	592	550	4	0	0	0	4	111	116
Dist. 4	14	5	4	0	5	0	84,674	524	641	2	0	1	0	1	152	158
East	39	21	3	0	14	1	170,781	614	530	8	0	0	0	8	128	114
Dist. 7-B	28	11	2	1	13	1	93,362	1,116	1,298	11	2	1	1	7	315	339
West	89	62	2	2	22	1	440,129	2,058	2,899	11	0	0	0	11	318	358
Dist. 9	60	36	1	0	20	3	136,203	1,429	1,762	3	0	0	0	3	201	308
Dist. 10	21	11	0	4	6	0	94,462	489	654	4	0	0	0	4	33	55
Utah	2	2	0	0	0	0	11,274	130	170	0	0	0	0	0	44	48
West Virginia	0	0	0	0	0	0	0	356	343	0	0	0	0	0	4	9
Wyoming	24	13	0	2	9	0	124,571	481	417	6	1	0	0	5	204	140
Misc. (Ia.)	1	0	0	0	1	0	1,500	53	58	1	0	0	0	1	47	29
Total U. S.	**916**	411	18	72	368	47	3,694,827	20,590	23,962	**192**	10	3	6	173	4,500	4,466
Previous week	847	389	28	72	343	15	3,811,340	.....	.....	184	12	1	5	166	....	....
Cum. 1960	20,590	9,707	641	1,644	8,005	593	90,072,613	.....	.....	4,500	400	50	147	3,903	....	....
Cum. 1959	23,962	12,210	600	1,730	8,880	622	99,342,796	.....	.....	4,466	466	63	134	3,823	....	....
Western Canada	47	30	0	7	10	0	215,937	1,005	1,174	11	2	0	3	6	290	370

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



DAILY AVERAGE PRODUCTION FOR WEEK

	June 25, 1960 Crude oil	Lease condensate	Total	June 18 total
Alabama	17,675	.....	17,675	18,100
Arkansas	76,975	100	77,075	77,200
California	833,800	.....	833,800	834,100
Colorado	125,400	.....	125,400	128,000
Eastern	38,900	.....	38,900	40,100
Florida	1,000	.....	1,000	1,000
Illinois	209,300	.....	209,300	209,800
Indiana	32,000	.....	32,000	31,400
Kansas	†289,210	.....	†289,210	†282,710
Kentucky	62,800	.....	62,800	63,100
Louisiana	924,700	126,400	1,051,100	1,051,200
North	107,700	5,900	113,600	113,700
South	817,000	120,500	937,500	937,500
Michigan	40,500	.....	40,500	40,500
Mississippi	136,750	.....	136,750	136,750
Montana	75,300	.....	75,300	75,000
Nebraska	65,200	.....	65,200	62,000
Nevada	100	.....	100	100
New Mexico	288,500	.....	288,500	288,500
North Dakota	60,600	.....	60,600	59,500
Oklahoma	†502,900	.....	†502,900	†525,300
Texas	2,374,000	87,900	2,461,900	2,461,900
Dist. 1	42,000	3,000	45,000	45,000
Dist. 2	100,000	8,200	108,200	108,200
Dist. 3	314,000	37,000	351,000	351,000
Dist. 4	163,000	18,000	181,000	181,000
Dist. 5	26,000	350	26,350	26,350
Dist. 6	102,000	9,000	111,000	111,000
East Texas field	123,000	.....	123,000	123,000
Dist. 7-B	126,000	150	126,150	126,150
Dist. 7-C	117,000	2,825	119,825	119,825
Dist. 8	958,000	6,500	964,500	964,500
Dist. 9	196,000	1,900	197,900	197,900
Dist. 10	107,000	975	107,975	107,975
Utah	104,200	.....	104,200	105,000
Wyoming	336,100	.....	336,100	335,000
Others	‡1,250	.....	‡1,250	‡1,240
Total U. S.	6,597,160	214,400	**6,811,560**	6,827,500
Change from prev. week, down	.....	.....	**15,940**	
Canada	†557,200	.....	†557,200	†566,400
Total U. S. Prod.-Jan. 1-June 25			1,247,844,830 bbl.	
Same period last year (crude plus cond.)			*1,267,046,500 bbl.	

*Includes 33,611,800 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

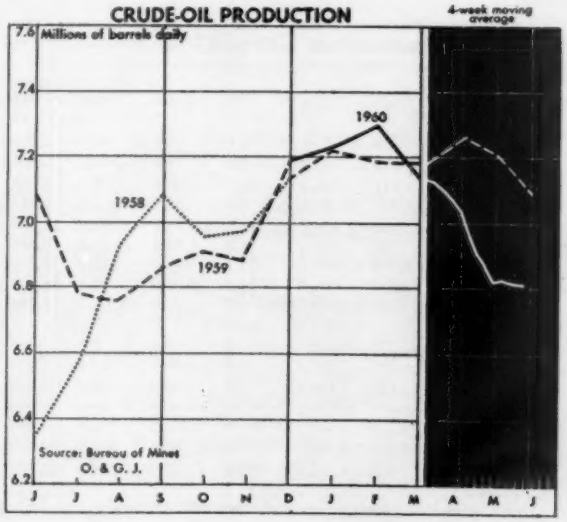
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	6-18-60	6-11-60	6-20-59
Pennsylvania	2,132	2,118	2,453
Other Appalachian	1,714	1,744	2,031
Illinois, Indiana, Michigan	10,367	10,272	9,524
Nebraska and North Dakota	2,716	2,556	2,821
Kansas	9,875	9,616	10,680
Oklahoma	18,543	18,211	16,497
Arkansas	1,870	1,873	2,089
Louisiana	19,296	19,346	18,550
North	2,905	3,452	3,083
South	16,391	15,894	15,467
Mississippi, Alabama, Florida	2,094	2,181	2,431
New Mexico	8,022	8,049	8,325
Texas	108,530	108,737	115,415
East Texas	8,591	8,558	9,610
West Texas	49,156	49,991	54,894
Texas Gulf	19,383	19,061	18,724
Other Texas	31,400	31,127	32,187
Wyoming	17,883	18,119	16,330
Other Rocky Mountain	10,263	10,388	9,690
California	33,368	33,266	36,438
Foreign	†12,284	12,427	12,455
Total	**258,957**	258,903	265,729

*Bureau of Mines. †Includes 4,595,000 bbl. in California.

CRUDE-OIL PRODUCTION



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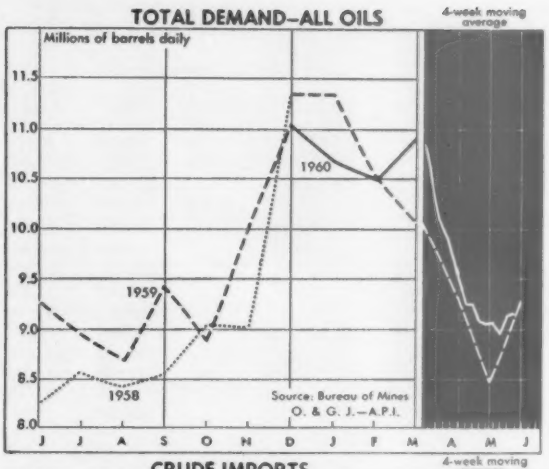

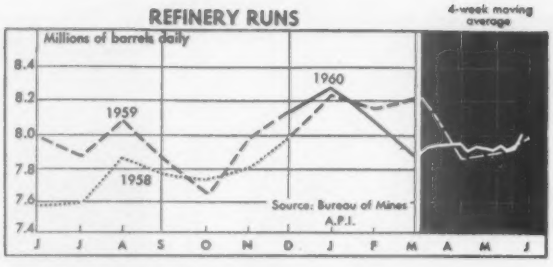

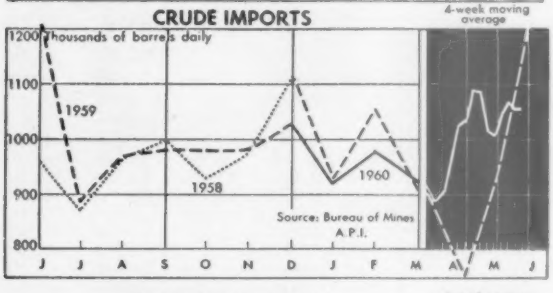

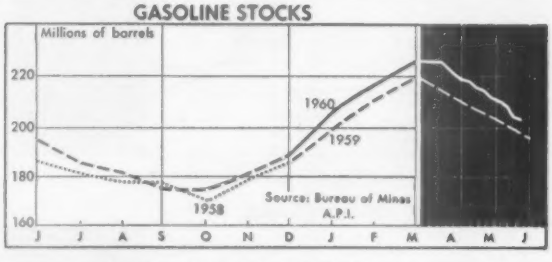

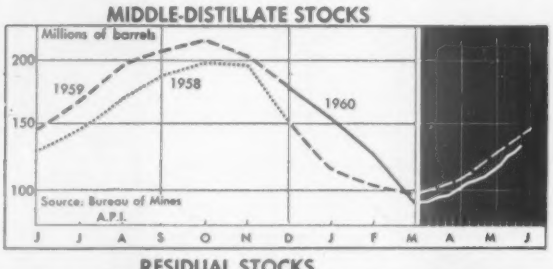

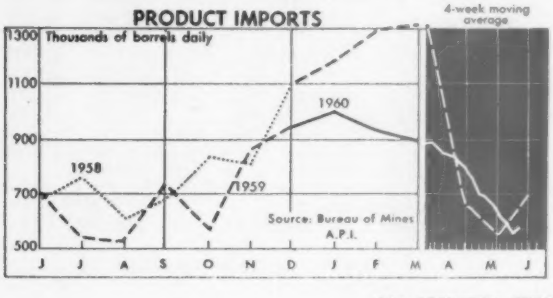

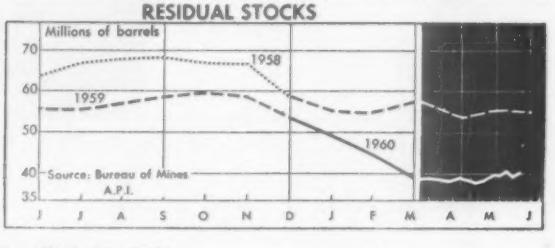

API REFINERY REPORT—JUNE 24, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,143	522.4	25.9	332.4	155.6	45,891	10,403	37,464	10,723	1,067	490.5	19.6	281.2	171.5
Appalachian:														
District 1	99	43.6	4.1	22.6	8.9	6,295	604	2,399	390	104	45.3	3.2	22.6	6.8
District 2	98	47.9	2.1	17.3	14.7	2,863	329	1,041	289	110	52.0	5.1	22.9	8.2
Ind., Ill., Ky.	1,511	769.4	49.3	323.4	159.6	35,958	5,369	18,685	4,757	1,497	777.9	62.7	302.4	147.9
Minn., Wis., Dak.	130	61.1	5.6	32.9	17.6	6,923	1,091	4,564	649	114	53.4	5.7	29.2	14.3
Okla., Kans., Mo.	730	406.6	16.0	175.7	18.6	18,789	1,324	9,334	1,040	759	417.3	12.8	179.0	23.7
Inland Texas	326	250.3	13.4	53.3	21.0	6,346	579	1,654	2,474	292	226.0	8.5	51.6	19.5
Tex. Gulf Coast	1,954	995.8	101.7	442.8	141.0	25,268	3,360	11,222	4,519	1,788	965.4	72.5	449.4	149.5
La. Gulf Coast	692	346.7	52.9	139.0	38.4	11,175	1,583	4,484	1,405	720	396.6	41.1	190.0	50.3
N. La. and Ark.	103	64.1	4.1	20.9	5.3	5,364	937	1,863	141	94	44.4	5.0	21.3	6.5
Rky. Mountain:														
New Mexico	26	16.0	0.7	5.1	2.1	706	39	152	9	24	12.3	0.1	4.6	2.6
Other Rocky Mt.	296	132.7	4.9	68.7	33.1	6,439	271	2,117	897	304	131.3	3.7	62.8	29.4
West Coast	1,123	494.1	36.9	178.3	256.4	31,225	1,694	11,712	13,299	1,117	516.9	3.8	174.6	284.7
June 24, 1960	8,231	4,150.7	317.6	1,812.6	872.3	203,242	27,583	106,691	40,592	7,990	4,129.3	243.8	1,791.6	914.9
June 17, 1960	8,034	4,211.7	379.9	1,790.1	868.1	204,372	26,883	103,045	39,879	.....	.....	.....	.....	.....
June 26, 1959	7,836	4,097.4	251.6	1,783.9	969.4	198,271	27,213	115,991	53,840	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.70
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.07
Buckeye Grade	4.07
Illinois Basin	**2.85-3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias (Grade A)	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS-37.5%)	$1.78
★ Carib.-NY, dirty (ATRS-60.0%)	1.10
★ Carib.-UK, clean (ATRS-15.0%)	5.53
★ PG-UK, dirty (Scale-62.5%) (24s. 2d.)	3.39

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
Regular (91 octane)	11.50
Premium (99 octane)	14.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
Premium (98 octane)	11.50-11.75
California (rack) Los Angeles:	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.25-9.375
★ Diesel oil (58 d.i. and above)	8.875-9.00
★ Distillate No. 1	8.875-9.00
★ Distillate No. 2	7.875-8.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.00
★ Distillate No. 2	8.125
New York Harbor (barges):	
Kerosine 41-43	10.05
Distillate No. 2	9.05
Diesel fuel, 48-52 d.i.	9.35
Caribbean area (cargoes):	
★ Distillate No. 2	8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.90
Gulf Coast (cargoes):	
★ Bunker C fuel	2.20-2.25
New York Harbor (barges):	
Bunker C fuel	$2.47
Caribbean (cargoes):	
Bunker C	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15

★Denotes change from previous week.

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FOR SALE EQUIPMENT

FOR SALE gasoline plant, shut down June 1, 1960. Will start dismantling immediately. Pumps, motors, engines, compressors, Tanks, towers, pipe, buildings and miscellaneous equipment. Three miles west of Burrton, Kansas. Representative will be at plant site Tuesday, Wednesday and Thursday of each week. Contact Cowden, Cities Service Oil Company, Bartlesville, Okla.

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2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/8"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.

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NEW CROLOY 5 HEATER TUBES

Priced at ½ New Cost

Must Move at Once

14—3¾" x ⅜" wall x 44' long
63—4" x ⅜" wall x 26' long
10—4" x ⅜" wall x 32' long
50—4" x ½" wall x 32' long
3—5" x ½" wall x 42' long
42—6" x ½" wall x 27' to 47' long

HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

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AMOCO REF. DESTREHAN, LA.

BOILERS, 70,000 #/hr. & 80,000 #/hr. 450 Psi.
HORTONSPHERES, 5,000 & 10,000 bbl.
EXCHANGERS, 78 to 2,800 sq. ft.
TOWERS, 3 ft. to 7½ ft. diameter.
VESSELS, 2 ft. to 10 ft. diameter.
FURNACES, 26 MM BTU/hr.
TURBO EXHAUSTERS, 15,360 & 17,000 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 290 HP.
TANKS, 1,000 to 29,000 bbl.
COMPRESSORS, (IR) XVG—4 & XVG—2.

BRILL EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
35-53 JABEZ ST. NEWARK, N. J.
4101 SAN JACINTO, HOUSTON, TEXAS

FOR SALE EQUIPMENT

1—1958 FAILING, special model 1500 rotary drill, only cut 2,000 feet of hole. Machine equipped with 2⅞" H. D. retracting rotary drill head, with 20" hydraulic stroke feed, Gardner-Denver 5 x 8 mud pump powered by separate IHC U-450 gas engine, 42' tubular steel mast, model Q-54-A P. T. O. friction clutch sand reel assembly with double brake bands, double brakes on hoisting drum, automatic pull-down assembly, heavy duty mast platform and rod rack, 8⅝" opening H. D. power break-out table, hydraulic breakout cylinder, tong-lines and counter-weights, S-1050-AH. D. bail-type water swivel, 2⅞" x 26', 6" round fluted Kelly, 50 Joints 2⅞" x 20 drill pipe mounted on International 172 tandem truck, actual mileage 1,387 and misc. extra tools. Cost new $36,000. Priced for quick cash sale at $21,500. For further details write or phone Union Pipe & Supply Company, Owensboro, Ky.

LIQUIDATION

at ESSO REFINERY Balto., Md.

TOWERS

10' x 145'—125 PSI 50 trays
9'6" x 121'—325 PSI 30 trays
8'6" x 103'—165 PSI 24 trays
7'0" x 82'— 75 PSI 30 trays
6'0" x 80'—300 PSI 30 trays
4'0" x 44'—150 PSI 12 trays
3'6" x 36'—400 PSI 12 trays
2'6" x 52'—360 PSI 22 trays
2'2" x 57'— 85 PSI 4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube ..... 7,500 to 100 sq. ft.
Adm. Tube ..... 3,500 to 236 sq. ft.
Cu Ni Tube ..... 2,330 to 908 sq. ft.
S. S. Tube ..... 1,000 to 170 sq. ft.
BLOWERS—11,880 CFM @ 11 PSIG
INSTRUMENTS—Controllers, Recorders, Indicating and Transmitting
MOTORS—10 HP to 500 HP XP
PIPE CHROME—3¾" to 14" OD
PUMPS—Hot Oil, Steam, Centrifugal
REACTOR—8' x 32'6" OA
REBOILERS—2,700 to 450 sq. ft.
TRANSFORMERS—5 KVA to 333 KVA
VALVES—Diaphragm, Butterfly Slide and Pressure Regulating
VESSELS PRESSURE—3' to 12' Dia.

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Box 5203, Baltimore 24, Maryland

FOR SALE EQUIPMENT

THOR AIR drills: Model WB 62-reversible. Unused gov't. surplus 2" cap. in wood. $69.00 cash. F.O.B. The Drill & Service Company, P. O. Box 54, Wyoming, Pa.

TWO REDA PUMPS for 5½" casing complete with control panels, No. 4 cable and protecters. One with transformer and generating unit. For additional information contact Tennessee Gas Transmission Company, Box 163, Great Bend, Kansas.

WELL DRILLS, core drills. Everything for well and core drilling. New and used equipment at money saving prices. Everything in supplies. Nationwide sales. Send for bulletins—Pressey & Son, Pueblo, Colorado.

FOR SALE on bid basis—one operating gas plant and pipe line system, Magnolia, Arkansas, daily capacity approx. 23 MMCF, 90,000 gallons. Contact Shell Oil Company, Mr. O. H. Hanyka, Magnolia, or H. B. Grist, Express 1331, New Orleans, Louisiana.

FOR SALE: Small gas treater for hydrogen sulphide removal. Unit recently shut down and in good operating condition. Box L-885, The Oil and Gas Journal, Tulsa, Oklahoma.

PLATFORM TYPE power drilling rig, 14,000 ft. capacity for sale on a bid basis at Morgan City, Louisiana. Rig unitized for quick move. Contact Shell Oil Company, W. L. Brady at Morgan City, or H. B. Grist, Express 1331, New Orleans, Louisiana.

FOR SALE—Star 76 top to bottom rig 3,500' capacity 3 sets of tools 12" to 4" dog house hand tools light plant nothing else to buy. Ready to Drill. Located Central Kentucky. Koons, 222 North 8th St., Mt. Vernon, Illinois.

1—COMPLETE UNIT Rig for sale, U-34 Drawworks Powered by 2 WAKBU Waukesha engines. Sub-structure. 96' Lee C. Moore Derrick. Drill pipe 4½". Drill Collars. Located in Utah. Contact M. Rumsey, 330 South Socora, Wichita, Kansas. Parkview 21024. Complete inventory on request.

EQUIPMENT WANTED

FAILING 2500, Joy 300, or Franks 35 Drilling Rig. With or without accessories. Forward complete details first letter. Must be priced right for quick sale. Box L-871, The Oil and Gas Journal, Tulsa, Oklahoma.

WE ARE interested in the purchase of your depleted wells for salvage. Also, used casing, tubing, units, tanks, etc. Must be in Kansas area. The Buckeye Supply Company of Kansas, Inc., 105 S. Main, El Dorado, Kansas.

127 FT. Lee C. Moore Jackknife Derrick. 7' or 8' Substructure for 3 engine compound. Box L-891, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED TO BUY, for cash, Cardwell or Bucyrus-Erie spudder with reels to spool four thousand feet lines. No tools, wire, or casing tools are needed. Must be in good condition, ready to run. Please state number of wells drilled and age of Machine. Box L-893, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

EXPERIENCED REFINERY instrument man, or helper, familiar with Foxboro pneumatic and large case electronics. For work in modern integrated refinery. Salary $2.72 per hour, plus time and one-half and double time. Send resume of experience to Personnel Director, Delta Refining Company, P. O. Box 3097, Memphis, Tennessee.

HELP WANTED

PETROLEUM ENGINEER—with production experience and sales ability, wanted by Houston Production Equipment Manufacturer. Box L-892, The Oil and Gas Journal, Tulsa 1, Oklahoma.

LABORATORY TECHNICIAN, experienced in paleontologic preparation, to look after invertebrate paleontology laboratories and collections. Salary dependent on qualifications, range $3200-$6500. Permanent job with ideal working conditions and excellent employee benefits. Write: Karl Waage, Peabody Museum, Yale University, New Haven, Conn.

SALESMAN for line of automated chemicals and maintenance detergents for the oil and gas industry. Sales training. Position open about July 25. Write Chemicals, P. O. Box 341, Dallas 21, Tex.

GEOLOGIST TO take charge of exploration for small but aggressive company operating chiefly in the Anadarko Basin. Prefer independent background with good field experience. An excellent opportunity for the right man. Send complete resume including experience, transcripts and references. We will contact you in regard to an interview. Box L-868, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

STAFF ENGINEER: Large, independent, integrated oil company with home office in Southwest has opening Natural Gasoline Dept. Must have had a minimum of 3 years experience in design and operation of natural gasoline plants and facilities. Graduate engineer with major in chemical, petroleum or refining. Submit complete resume. Box L-879, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER—12 years diversified experience drilling and production, Texas and Louisiana Gulf Coast. Licensed Texas and Louisiana. Married, age 41, resume available. Box L-896, The Oil and Gas Journal, Tulsa, Oklahoma.

CONTROLLER-OFFICE Manager for independent company, available August 1. Licensed attorney, major company experience. Familiar land leases, taxes, budgets, financial statements, joint interest accounting. Charles Ben Howell, 805 Newell, Dallas, Texas.

PETROLEUM GEOLOGIST Age-26. B.S. Degree from O.U. Two years exploration experience, Mid-Continent. Excellent success ratio. Jim Mundy, Pawhuska, Okla.

ELECTRICAL ENGINEER 34, B.S., 7 years with Latin American Major, varied electrical, control, and construction background. Desires position, foreign or domestic, with future potential. P. O. Box 313, Ft. Collins, Colorado.

CHEMICAL ENGINEER—Four years petroleum refinery experience, including pilot plant studies, trouble-shooting, operating supervision, some maintenance, economics and forward planning. Desires supervisory position medium sized oil or petrochemical company. Resume or request. Box L-881, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST - ENGINEER (BS) - Western Canada, Williston Basin, Oklahoma, and Texas. 4½ years experienced in all phases of geology and production. 1½ years tubingless completions. Consultant for past year. Desires responsible position with active independent. Box L-883, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

HIGHEST PRICE paid for income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

WANT LISTINGS of producing royalties and non-producing royalties. Give full information. R. E. Clement, Box 65, Norman, Oklahoma.

FOR SALE: Oil and Gas Royalty under 500 acres in Scipio Oil field, Jackson Co., Michigan. Non producing offsets flowing, drilling on property soon. Also a farmout in trend. Donald Davis, Phone VI 9-9118, Jonesville, Michigan or Phone 972-2, Bluffton, Indiana.

REAL ESTATE

MEXICAN RANCHES—Two 20,000 acre ranches west of Saltillo, Coahuila State, about 150 miles from border. Good title, $3.50 per acre, suitable for cattle or recreation. Box L-895, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCING

CAPITAL needed to drill offset production in West Virginia oil bringing 4.07 at well. Gas—.25c per thousand, in West Virginia, big play. David W. Law. Phone: HU 5-6446, 716 Union Trust Building, Parkersburg, West Virginia.

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FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

INQUIRIES SOLICITED by investors interested in participating financially in the drilling of wells for oil and gas. Speculative but financially attractive. J. P. Tucker, Box 951, Longview, Texas. 30 years experience.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box L-894, The Oil and Gas Journal, Tulsa, Oklahoma.

INCOME PROPERTY—COLOMBIA: Will sell beautiful drive-in property now operating as high class restaurant, 24 tables, fully equipped kitchen, located on main highway, 46 miles from Bogota, capital of Colombia, South America, 4675 ft. elevation, Andes Mountains. Guest accommodations, swimming pool, wonderful opportunity for couple which has lived in South America, want to retire with modest income and leisure. Price $28,000. Terms. Write owner: Apartado Aereo 49-45, Bogata, Colombia.

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Major company makes first Devonian discovery in Utah. 575 barrels of oil per day. Also large production from Pennsylvanian and Mississippi formations. Send for free maps and information, an our system, of hedging on oil and gas leases. Send now:

ATLAS OIL SURVEY
Dept. OGJ-7
Colorado Building, Denver 2, Colorado.

PRODUCTION WANTED

PRODUCING LAND Owners royalty for sale. 10 acres paying $27. month. Settled, under 160, 5,000 ft., major company. 3 more locations. $250.00 acre. Jimmy Nix, Box 3041, Oklahoma City, Okla.

LEASE AND DRILLING BLOCKS

FOR SALE—184 acres perpetual minerals, Hemphill County, Texas, next to Oklahoma line. 80 acres not leased. Must sell. Address 310 Braniff Bldg., Oklahoma City, Okla.

BOTTOM HOLE pay offset and close-in acreage to J Sand test 6800' 22-3N-61W Denver Basin. G. N. Babcock, Chanute, Kansas. Phone 1531.

FOR ASSIGNMENT 590 acres Ohio County, Ky. Two miles north of Hartford. Bordered on two sides by definite faults. A. J. B. Oil and Exploration Co., P. O. Box 1121, Harlingen, Texas.

THOUSAND acres covering complete old pool, drilled 1904-1916, 8 wells still pumping, average depth 700 feet. Little water, low pressure, water available for flood. Charles Howard, Monticello, Kentucky. Phone Fllmore 8-2461.

EASTERN KANSAS proven Bartlesville production 740 ft. deep, 3 inside locations, 4/8 working interest for sale. $500.00 per 1/8 to drill No. 1. For details write: Box L-882, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE in Breckinridge Ky. 13,000 acres of oil and gas leases. 5 year terms, 10,000 acres straight 5 years, no rental. Over 100 producing wells in county. Several rigs now drilling. $1.50 per acre. Depth to Devonian formation 900 to 1200 ft. Call or write: Phone SK 6-2078—Hardinsburg Ky., call after 5 P.M. Rosco Kiper, Kingswood, Kentucky.

HAVE 300 acres royalty for sale Ellis County Oklahoma in area which has good geology. Fletcher Bowles, Box 812, Oklahoma City. Phone CE 6-5405.

HAVE SEVERAL lease blocks South Georgia on Gravity Survey Highs. Want Drilling Deals with financially interested people or owner of portable slim hole rotary rig. You furnish rig, I'll furnish labor, material. Ready to go. Oil and Gas seepage on area. T. R. Davis, 601 Jackson St., Vidalia, Georgia.

HAVE approved acreage in Ohio to farm out. David Law—Phone HU 5-6446, 716 Union Trust Building, Parkersburg, West Virginia.

CHEATMAN COUNTY, Tennessee: 3,000 acre block, geologic structure on producing trend, geologist has mapped surface, report available; 60 cents per acre, 3/32 override, Box 2493. Salt Lake City, Utah.

PICKETT COUNTY, Tennessee—100 acre adjoining Knox Sand production price $15.00, with 1/8 override block 720 acres price $5.50 with 1/8 override. We have drilling blocks and farmouts. Come inspect. Wire, phone Cravens & Thomas, Parkway Hotel Bldg., Burkesville, Kentucky.

3,500 ACRES $2 per acre. Lawrence County, Ky. In midst of new gas play. Ten year leases in first year, 1/8 override, no drilling committment, 50 cents per acre annual rental. U. S. Andersen, 8350 Santa Monica Blvd., LA 46.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

80 ACRE AND 90 acre leases in proven area. Need additional capital for drilling and completion. Shallow production Montgomery County, Kansas. S & M Drilling Co., Box 98, Cherryvale, Kansas.

LEGAL

SALE OF OIL AND GAS MINING LEASES, Department of the Interior, Bureau of Indian Affairs, Jicarilla Indian Agency, Dulce, New Mexico. Sealed bids will be received until 3:00 P.M., Mountain Standard Time, July 27, 1960, and then opened at that time in the office of the Jicarilla Indian Agency, Dulce, New Mexico, for the leasing of 37,262 acres of Tribal Indian land located in Rio Arriba County, New Mexico, within the Jicarilla Indian Reservation, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Jicarilla Indian Agency, Dulce, New Mexico.

Wyoming—(Cont.)

The 30 Unit, C NW NW 15-18n-99w, is at the southwest tip of production and inside the hamlet of Bitter Creek. It lies 3 miles southwest of the field discovery well. There is only one dry hole as yet in the field—NW NW 13-18n-99w. Two new wells are: 13 Unit, NW NW 12-18n-99w, (flowed 350 bbl. daily), and 20 Unit, SE NW 10-18n-99w (flowed 241 bbl. per day).

Discovery wells

WESTERN CANADA

Alberta:

Altair-Apache 7-22 Drumheller, LSD 7, 22-29-19w4. Glauconitic oil discovery. TD 5,409 ft.

Britalta-Hilda 10-32 Medicine Hat, LSD 10, 32-18-2w4. Medicine Hat gas discovery. TD 1,700 ft.

Zapata-Liedtke-B.A. 6-1 Mazy, LSD 6, 1-42-19w4. Detrital gas discovery. TD 4,010 ft.

Cancrude-Michigan Wisconsin 7-9 Hilda, LSD 7, 9-19-1w4. Medicine Hat gas discovery. TD 3,965 ft.

Dome 8-13 Boundary Lake, LSD 8, 13-85-14w6. Boundary Lake oil discovery. TD 4,253 ft.

INDIANA

Spencer County:

S. Payne 1 C. Ferguson, SW SW NW 17-5s-5w. IP 15 BOPD, McClosky 1,145-48 ft. TD 1,148 ft. Opens Lincoln Park pool.

Greer & Ware 1 Sam and Albert Varner, 31-6s-4w. IP 54 BOPD, O'Hara 963-968 ft. TD 968 ft. Opens Turner Chappel field.

KANSAS

Barber County:

Mobil Oil Co. 1 Rena McBrayer, SW NE SW 15-34s-14w. IP 1,680 M.c.f.d., Mississippian 4,826-4,942 ft. TD 4,990 ft. Extension to Northeast Aetna field.

Barton County:

Tomlinson-Kathol 1 Rusco, NW NW SW 3-19s-12w. IP 131 BOPD, 41.9°, Lansing-Kansas City 3,274-88 ft. TD 3,408 ft. East Cheyenne field discovery.

Alpine Oil & Royalty 1 Sharp. SE SW SW 35-20s-13w. IP 79 BOPD, 40.2°, Arbuckle 3,527-45 ft. TD 3,545 ft. Northeast Shaeffer field discovery.

Ford County:

Tennessee Gas Transmission Co. 1-A Barngrover, NE SE SW 26-27s-24w. IP 248 BOPD, 38°, Marmaton 4,874-83 ft. TD 5,238 ft. Opens Will Roads field.

Marion County:

Messman-Rinehart 1 Keil, C SE SE 24-18s-4e. IP 1,500 M.c.f.d., Miss. 2,289-2,314 ft. TD 2,374 ft.

Rooks County:

Tom Allan 1 Whisman, C N½ SE SW 24-10s-19w. IP 42 BOPD, 20% water, 33°, Lansing-Kansas City 3,408-12 ft. TD 3,580 ft. Opens Southeast Vohs field.

Seward County:

Falcon-Seaboard Drilling Co. 1 Salley, C NW¼ 33-33s-33w. IP 258 BOPD, Chester 6,194-6,208 ft., 40.3°, TD 6,502 ft. Opens Thirty Three field.

Stafford County:

Morris Garvin 1 Garvin, NW SW SE 27-22s-14w. IP 121 BOPD, 30°, Lansing-Kansas City 3,668-75 ft. TD 3,940 ft. Opens East Nellie field.

Sumner County:

Imperial Oil Co. of Kansas 1 Cole, SE SW NW 24-31s-4w. IP 97 BOPD, 47°, Simpson 4,411-15 ft. TD 4,458 ft. Opens Cole field.

Leben Drilling Co. et al. 1 Porter, SE NE NE 11-33s-3w. IP 150 BOPD, 45°, Simpson 4,448-52 ft. TD 4,452 ft. Opens Olive Branch field.

KENTUCKY

Daviess County:

Wilkerson Brothers 1 J. C. Shively, 9-0-32. IP 35 BOPD, Tar Springs 476-499 ft. TD 500 ft. Discovery of East Berry School field.

MICHIGAN

Oceana County:

Flory Drilling Co. 1 Baron, SE SE NW 21-14n-16w, Ferry Township, 5 miles southeast of Hart pool. IP 121 BOPD, 21/64-in. choke. Elev. 720 ft., Traverse lime 1,945 ft. Pay 1,949 ft. TD 1,950 ft. New oil field.

NEW MEXICO

Eddy County:

Pan American Petroleum Corp. 1 USA Yates-Federal, 3-19s-25e, 10 miles southwest of Artesia and 13 miles southwest of Empire-Abo field. IP 168 BOPD, 10/64-in., 45°, GOR 1,345 cu. ft. per bbl., TP 700 psi., perf. 5,740-50 ft., Wolfcamp. TD 6,100 ft. New-field discovery.

Sinclair Oil & Gas Co. 65-B Turner, 20-17s-31e, 7 miles southwest of Maljamar. IP 288 BOPD, 16/64-in., 43.1°, GOR 1,340 cu. ft. per bbl., TP 800 psi., perf. 7,120-52 ft., Abo reef. TD 7,497 ft. New Abo Reed discovery in Grayburg-Jackson field.

Wayne J. Spears 1-A Hanson-Federal, 27-16s-27e, 8 miles northeast of Artesia. IP 29.25 BOPD, 9.75 BW (sulfur), ½-in., 36°, perf. 1,325-29 ft., Grayburg. TD 1,438 ft. New pay discovery.

San Juan County:

El Paso Natural Gas Products Co. 1 Ojo Amarillo, NE NE 27-29n-14w. IPF 304 BOPD, 18/64-in. choke, Gallup 5,322-44 ft. TD 6,105 ft. Gallup discovery, new field.

NORTH DAKOTA

Renville County, Eden Valley:

British-American Oil Producing Co. 1 Van De Erv, SW SE 15-163n-84w. IPP 37 BOPD, 100 BWPD, 27.1°, Mission Canyon discovery, new field, TD 4,272 ft.

OKLAHOMA

Beaver County:

Stekoll Petroleum-Panhandle 1-26 Ellis, C NE SW 26-3n-23eCM. IP 2,400 M.c.f.d., Morrow 7,478-96 ft. TD 7,749 ft. New field.

Creek County:

Carter and Mandel Co. 1 Lamons, NE NE NW 14-14n-9e. IP 62 BOPD, 34°, Wilcox 3,742-52 ft. TD 3,750 ft. New oil field.

Dewey County:

Humble Oil & Refining Co. 1 Spangler, SW NE 13-17n-19w. IP 48 BOPD, 44°, Tonkawa 7,820-36, 7,850-56, 7,879-7,918 ft. TD 12,148 ft. New field.

Amerada 1 Bartenback, C NE SW 15-18n-18w. IP 41,500 M.c.f.d. Morrow 10,388-10,418, 10,350-72, Morrow 10,320-44 ft. TD 10,546 ft. New gas discovery.

Calvert Drilling Co. 1 Jay-Foster, C NE SW 31-18n-17w. IP 4,500 M.c.f.d., Oswego 8,893-8,902 ft. TD 10,570 ft.

Garfield County:

G. K. Industries Inc. 1 Hayton, SE NE NE 23-24n-3w. IP 40 BOPD, 44°, Marshall 4,806-99 ft. TD 4,899 ft.

Grant County:

Sun Oil Co. 1 Fay W. Cake, C NW NW 28-25n-4w. IP 86 BOPD, 48.9°, First Wilcox 5,992-6,014 ft. TD 6,019 ft.

Haskell County:

Ambassador Oil Corp. 1 Steele, SW NW NE 5-7n-20e. IP 5,200 M.c.f.d., basal Atoka 5,656-66, 5,668-78 ft. TD 6,230 ft. Gas discovery.

Kingfisher County:

Jones & Pellow Oil Co. 1 Carrie, NW NW 26-19n-6w. IP 254 BOPD, 39°, Oswego 6,252-60 ft. TD 6,860 ft. Oil discovery.

Latimer County:

Midwest Oil Corp. 1 Orr, 8-6n-22e. IP 17,847 M.c.f.d., Atoka 7,193-7,330 ft.; Spiro 11,514-68 ft. TD 12,650 ft. Gas discovery.

McClain County:

Lyle Johnson 1 Guffin, NW SE 32-6n-2w. IP 317 BOPD, 40° and 43°, Bromide 8,401-41 ft.; Hunton 7,511-32 ft. TD 8,493 ft. Dual zone oil discovery.

McIntosh County:

Snee & Eberly 1 Kennedy, NE SW SE NE 4-10n-13e. IP 871 M.c.f.d., Jefferson 3,202-8, 3,212-14 ft. TD 3,945 ft.

Major County:

Oklahoma Natural Gas Co. 1 Greer-Unit, NE SW 18-22n-10w. IP 877 M.c.f.d., Manning 6,737-44, 6,747-53, 6,755-77 ft. TD 6,860 ft. East Forrest Home discovery.

Osage County:

Big Four Petroleum Co. 3 Bird, NW SW SW 33-22n-7e. IP 40 BOPD, 40°, Wilcox 2,728-46 ft. TD 2,751 ft.

Pottawatomie County:

Mid American Minerals and Humble 1 Bruno, SE SE SW 30-8n-3e. IP 20 BOPD, 196 BWPD, Simpson 5,312-54 ft., Hunton 4,893-4,904 ft. TD 5,400 ft.

Stephens County:

Shell Oil Co. 1-23 Cash Unit, C SE SW 23-1n-8w. IP 173 BOPD, 35.9°, Missouri 6,841-68 ft. TD 8,412 ft. New pay at Southeast Stage Stand.

Woodward County:

Shell 1 Blasdel, SW NE 21-23n-22w. IP 5,850 M.c.f.d., Morrow 8,137-51 ft. TD 8,525 ft.

TEXAS PANHANDLE

Hemphill County:

Gulf Oil Corp. 1-H Bowers et al., Section 255, Block C, G&MMB&A Sur., 22 miles southeast of Canadian. AOF 27 M.M.c.f.d.. shut-in TP 6,607 psi., open hole 13,576-611 ft., Pennsylvanian. TD 13,611 ft. Discovery well—Washita Creek (Penn.) field.

Gulf Oil Corp. 1 A. Bowers et al., 255, Blk. C, G&MMBA Sur., 22 miles southeast Canadian. IPCAOF 27 M.M.c.f.d., Penn. granite wash 11,250 ft. TD 13,611 ft. New gas discovery.

TEXAS GULF COAST

Harris County:

Carmac Oil Co. 1 Humble Oil & Refining Co., Lot 8, Block 1, William Scott Lower League, 1 mile northeast of Baytown. AOF 26,500 M.c.f.d., dry gas, shut-in TP 1,660 psi., perf. 4,258-64 ft., Lower Frio. TD 4,621 ft. New pay in Goose Creek field.

Jackson County:

H. H. Howell 2-B O. E. McNeil, John Andrews Sur., A-4, 6 miles northwest of

Edna. IP 68 BOPD, 7/64-in., 21.6°, GOR 905 cu. ft. per bbl., TP 500 psi., perf. 2,459-68 ft., Catahoula. TD 2,618 ft. New-field discovery—East Collier area.

Kleberg County:

Arkansas Fuel Oil Corp. 1 L. B. Strubbart, Section 22, Theodore F. Koch 1st Subd. Riviera Lands, G. Trevino Sur., A-232. 3 miles southeast of Riviera. IP 149 BOPD, 9/64-in., 37.9°, GOR 649 cu. ft. per bbl., TP 775 psi., perf. 8,754-57 ft., Frio. TD 9,510 ft. New pay in South May field.

Liberty County:

Draper, Goodale & Co. 1 Sophia Seaberg Estate Lease "D," Lot 14, T&NO Farm Lots Subd., Liberty Town West League, 1¾ miles northwest of Dayton. IPP 160.84 BOPD, 37°, GOR 415 cu. ft. per bbl., perf. 8,320-48 ft. TD 8,505 ft. New pay in South Martha field.

WEST TEXAS

McCullock County.

Low Drilling Co. Inc. 1 Warren Caylor, 2.5 miles northwest of Fife in H&TC Sur. 143. IPAOF 940 M.c.f.d., Strawn 976-986 ft. TD 1,611 ft. New gas discovery.

1 D. C. Randall in A. M. Waldrip Sur. 146. IPAOF 2,525 M.c.f.d., Strawn sand 1,346-1,364. TD 1,649 ft. New gas discovery.

Pecos County:

Reymeyer & Engal 1 McDonald, OWPD, 5 miles north Bakersfield, Sec. 28, Blk. 11, H&GN Sur. IPCAOF 3,800 M.c.f.d., Yates 840-52 and 873-78 ft. TD 1,527 ft. PBTD 944 ft.

Runnels County:

Callihan Interest, Inc. et al. 1 Clara Nitsch, OWDD. ½ mile northwest of Winters in D. Floyd Sur. 518. IPP 52 BOPD, Gardner lime 4,335-39 ft. 46.3°, GOR 850:1. TD 4,870 ft. New oil field.

J. H. Couch, Jr. 1 Lulu Overman, 1½ miles northwest of Wilmeth in Subd. 10, Edward Conley Sur. 445. IPF 127 BOPD, ¼-in. choke, Gardner sand 5,003-11 ft., 42.8°, GOR 907:1. TP 235 psi. TD 5,028 ft. New oil discovery.

Yoakum County:

Pan American Petroleum Corp. 1 Millie S. Courtney, Sec. 4, Blk. D, John H. Gibson Sur. IPF 213 BOPD, 15/64-in. choke, 32°, GOR 90:1, TP 80 psi., CP 250 psi., Upper Clear Fork 6,572-6,602 ft. TD 8,600 ft. PBTD 6,818 ft. New oil discovery.

UTAH

Grand County:

Stateline. B. W. Hancock 4 Government, SW SW 9-17s-25e. IPF Dakota 1,279 M.c.f.d., Cedar Mountain 2,450 M.c.f.d., Dakota 3,858-96 ft., Cedar Mountain 3,956-78 ft. TD 4,450 ft. Dakota gas discovery, new pay.

Uintah County:

Fence Canyon Unit. Texaco Inc. 1 Unit, NE SE 36-15s-22e. IPF 5,200 M.c.f.d., Dakota 8,544-80 ft. TD 10,348 ft. Dakota discovery, new field.

DeKalb Petroleum-Texaco Inc. 2 Uintah Unit, NW NW 35-19s-20e. IPF 2,200 M.c.f.d., open, Wasatch 5,061-5,606 ft. TD 5,672 ft. Wasatch discovery, new field.

WYOMING

Campbell County, Southwest Raven Creek:

Kewanee Oil Co. 1 Norman, NE NW 14-48n-69w. IPP 440 BOPD, Minnelusa discovery, new field, Minnelusa 8,338-65 ft. TD 8,514 ft.

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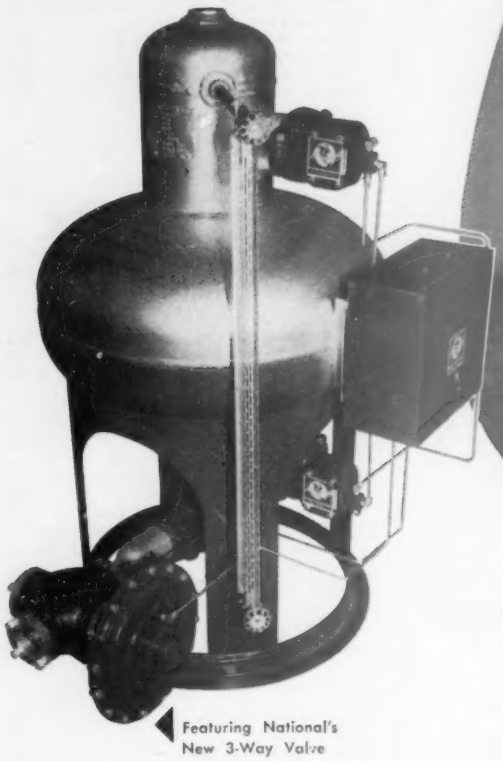

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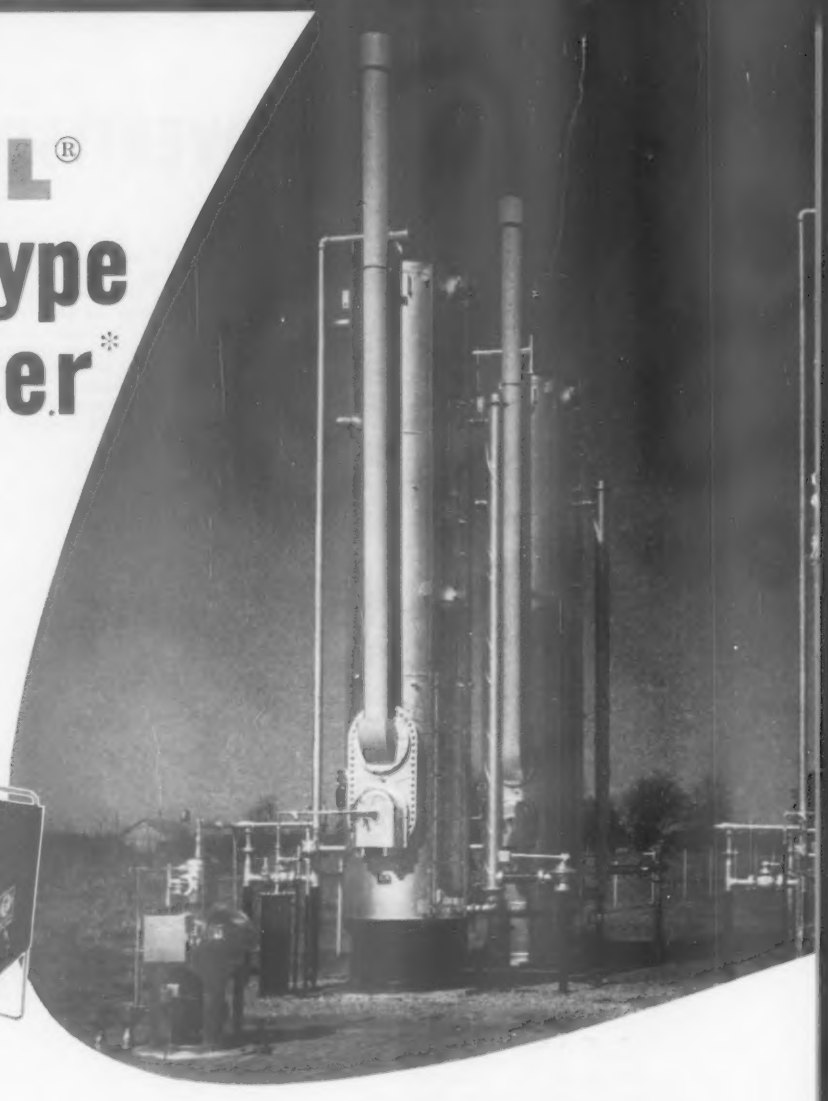

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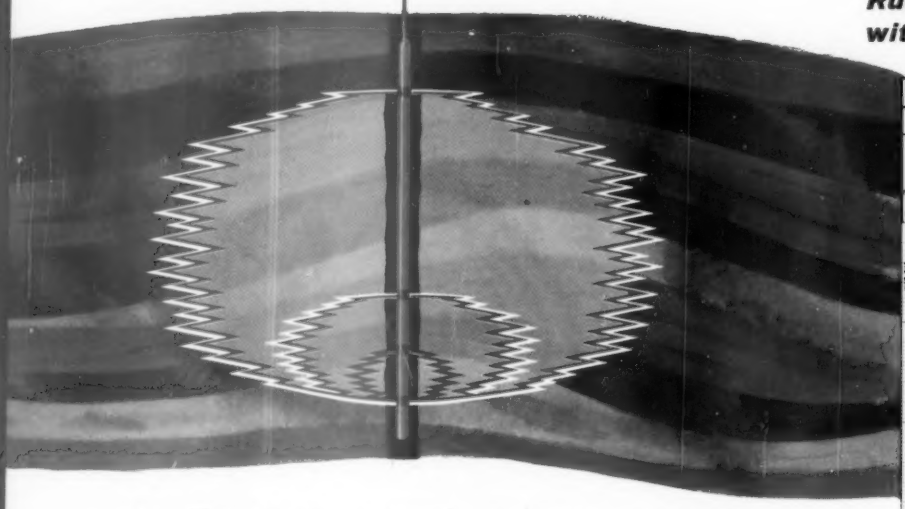

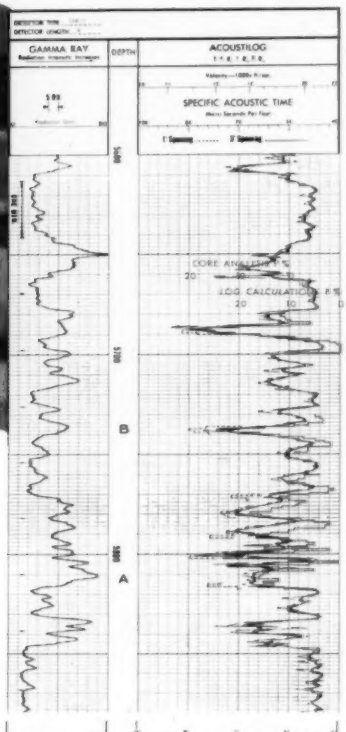

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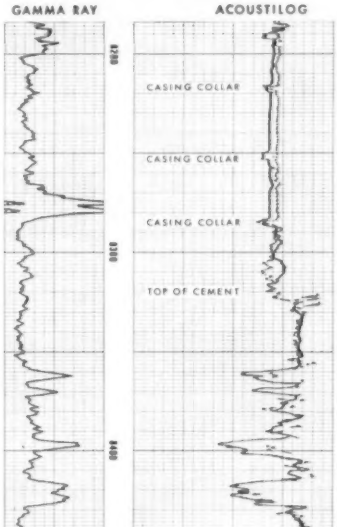

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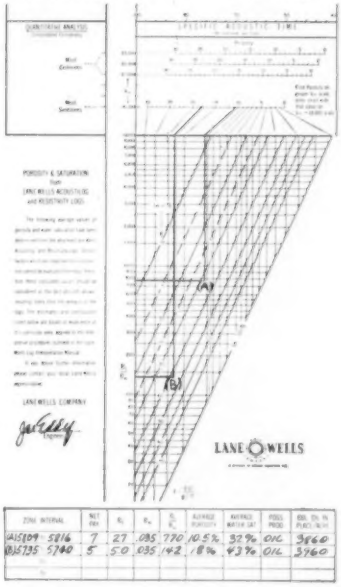

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